UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

UNIVERSITY OF MICHIGAN
APR 26 1957
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Volume 7

Abstracts 3643 - 4216

1953

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NUCLEAR SCIENCE ABSTRACTS

Volume 11 April 15, 1957 No. 7

GENERAL

ATOMIC BOMBS AND WARFARE

3643 AECU-3403
RAND Corp., Santa Monica, Calif.
ATOMIC CLOUD HEIGHT AS A FUNCTION OF YIELD AND METEOROLOGY. W. W. Kellogg. June 14, 1956. 16p. Project No. 4. Contract AT(11-1)-135. (P-881-AEC). $3.30(ph OTS); $2.40(mf OTS).

The height of burst and yield of a nuclear device have a vital effect on the subsequent fallout, since the size distribution of the radioactive particle is determined by the amount of contact between the initial fireball and the ground. The development of the fireball into a toroidal cloud or smoke ring and its rise are described. It is shown how the atmospheric stability affects the height to which the cloud rises, and the shape which it acquires when it reaches its ceiling. Finally, the dimensions of atomic clouds are presented as functions of yield and typical stability conditions. (auth)

3644 AECU-3405
RAND Corp., Santa Monica, Calif.
A MATHEMATICAL MODEL OF THE PHENOMENON OF RADIOACTIVE FALLOUT. R. R. Rapp. June 15, 1956. 15p. Contract AT(11-1)-135. (P-882-AEC). $3.30 (ph OTS); $2.40(mf OTS).

A calculated fall-out pattern was formulated for a hypothetical atomic cloud. The procedure was programmed for the IBM-701, which provided for a hundred intervals of heights and a hundred intervals of particle size. The data can be applied to estimates of fall-out pattern, and comparison of data with observed facts applied in a more accurate prediction of fall-out for an actual event. (C.H.)

3645
ON THE EFFECTS OF ATOMIC EXPLOSIONS ON THE CONDITIONS IN THE ATMOSPHERE. N. S. Smirnov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 1227-31(1956) Oct. (In Russian)

Effects of atomic bomb explosions on the increase in the atmospheric radioactivity and its influence on the weather has been reviewed. (R.V.J.)

Refer also to abstract 3669.

ATOMIC POWER

3646 BSC-2054-11(Rev.)
Bethlehem Steel Co. Shipbuilding Div., Quincy, Mass.
ANNUAL PROGRESS REPORT, SEPTEMBER 30, 1954 TO SEPTEMBER 30, 1955; USAEC STUDY AGREEMENT. Sept. 30, 1955. 43p. $0.30(OTS).

The design of a nuclear powered merchant vessel, the design of a nuclear powered distilling plant, and a general survey of reactor types to determine applicability of each to marine propulsion are discussed. (J.E.D.)

3647
FINANCIAL PROTECTION AGAINST ATOMIC HAZARDS. Arthur W. Murphy. New York, Atomic Industrial Forum, Inc., 1957. 71p.

The problems involved and recommendations for a program by the national government are outlined. (B.J.H.)

BIOLOGY AND MEDICINE

RADIATION EFFECTS

3648 AF-SAM-56-90
School of Aviation Medicine, Randolph AFB, Tex.
BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. SPINAL REFLEX ACTIVITY AND LOCAL X-IRRADIATION. Eugene B. Konecci and M. B. Danford. Mar. 22, 1956. 10p.

The normal rat tail withdrawal reflex was determined by a water bath stimulus (42° to 56°C). Latency of response, as a function of temperature, was found to be approximately exponential. The effect of irradiation of the local spinal cord (T-9) and of the distal 3 inches of the tail on the tail reflex was studied. The control animals gave a relatively constant reflex response while the local spine irradiated animals (15, 20, 30 kr) first showed a decrease in response time and then showed an increase until reflex was abolished. In the local tail irradiated animals some variation in response time was observed but the response never disappeared. Spinal cord damage was not direct. Edema at the locus of irradiation indicated blood vessel damage; the surrounding muscles showed numerous petechiae. (auth)

3649 HW-46409
Hanford Atomic Products Operation, Richland, Wash.
PHYSIOLOGICAL PARAMETERS FOR ASSESSING THE HAZARD OF EXPOSURE TO RUTHENIUM RADIOISOTOPES. II. CHRONIC EXPOSURE STUDIES. J. E. Ballou and R. C. Thompson. Dec. 1, 1956. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Chronic exposure of rats to Ru^{106} in their drinking water for periods of up to 500 days resulted in tissue Ru concentrations of comparable hazard concern in kidneys, bone, and gonads. Because of uncertainties inherent in the extrapolation of the rat data to man, an unequivocal choice of critical organ among these three possibilities cannot be made. Based on a permissible dose to the critical organ of 0.3 rem per week, the maximum permissible concentration for Ru^{106} in water is calculated to be 4×10^{-3} $\mu c/ml$. This would be approximately correct on the assumption of either kidneys, bone, or gonads as critical organ. (auth)

3650 PB-121300
Iowa State Coll., Ames. Agricultural Experiment Station.
CHEMICAL CHANGES IN PROTEIN OF STERILIZED MEAT. Termination Report No. 7 [for] April 1, 1954–September 30, 1955. Sidney W. Fox. 21p. Project No. 7-84-01-002. Contract DA-44-109-qm-1762.

Ionizing radiation does not destroy the amino acids in a protein extensively, nor does extensive peptide bond cleavage appear. Casein undergoes loss of a small proportion of methionine and tyrosine. Hamburger does not break down or lose any of the amino acids studied to a measurable degree. (auth)

3651 PB-121302
Oregon. Agricultural Experiment Station, Corvallis.
FLAVOR OF FOODS STERILIZED BY COMBINING CONVENTIONAL PROCESSING WITH IONIZING RADIATIONS.

Termination Report No. 10 [for] April 23, 1954 to October 22, 1955. H. W. Schultz. 51p. Project No. 7-84-01-002. Contract DA-44-109-qm-1782.

Results are reported from a study on the effect of various methods of processing when combined with sterilization by ionizing radiations on the flavor of meat and meat products. Data are presented on whole cuts and ground beef and pork. (C.H.)

3652 USNRDL-TR-125

Naval Radiological Defense Lab., San Francisco.

EXPERIMENTAL PATHOLOGY OF SEVERE THERMAL INJURY. E. L. Alpen, A. K. Davis, and R. Reed. Dec. 2, 1956. 20p. Project NM-006-015.02.

Studies of organ pathology in severely burned rats and dogs for a prolonged period have revealed several characteristic pathologic entities associated with severe thermal injury. In the rat there is a marked enlargement of both the liver and spleen and a moderate increase in kidney size. There is no alteration in fluid or blood spaces in either spleen or liver to account for increased size. The most marked pathologic entity in the rat is active extramedullary hematopoiesis in spleen and liver. In the dog the same organ size increases are to be found but not for to such a striking extent. Again active extramedullary hematopoiesis is the significant general finding. A specific adrenal lesion, periadrenal hemorrhage, has been identified in both dog and rat substantiating the observations of earlier workers on human autopsy material. (auth)

3653

EFFECT OF IRRADIATION ON IN VIVO P^{32} INCORPORATION BY FOUR TYPES OF ASCITES TUMORS. Helen Harrington, Diana Rauschkolb, and Paul S. Lavik (Western Reserve Univ., Cleveland). Cancer Research 17, 34-7 (1957) Jan.

3654

A STUDY OF DIRECT AND INDIRECT EFFECTS OF IRRADIATION ON P^{32} INCORPORATION BY EHRLICH ASCITES TUMOR CELLS IN VIVO AND IN VITRO. Helen Harrington and Paul S. Lavik (Western Reserve Univ., Cleveland). Cancer Research 17, 38-42(1957) Jan.

3655

NUCLEIC ACID METABOLISM IN EHRLICH ASCITES TUMOR CELLS. Helen Harrington and Paul S. Lavik (Western Reserve Univ., Cleveland). Cancer Research 17, 43-7(1957) Jan.

3656

EARLY CYTOLOGICAL CHANGES IN THE MARROW OF ANIMALS EXPOSED TO PENETRATING RADIATION. T. M. Kondrat'eva (Central Research Inst. of Roentgen-Radiology). Doklady Akad. Nauk S.S.S.R. 111, 89-91(1956) Nov. 1. (In Russian)

3657

EFFECTS OF IONIZING RADIATION ON THE SEX CELLS OF MISGURNUS FOSSILIS. A. A. Heĭfakh (Severtsov Inst. of Animal Morphology). Doklady Akad. Nauk S.S.S.R. 111, 585-8(1956) Nov. 21. (In Russian)

3658

CARBOHYDRATE METABOLISM OF LIVER DURING THE RADIATION SICKNESS. N. N. Blokhin, I. S. Luzanova, and L. S. Rotfel'd. Doklady Akad. Nauk S.S.S.R. 111, 723-6 (1956) Nov. 21. (In Russian)

Carbohydrate metabolism of liver and muscles of irradiated dogs were studied by the functional loading method. (R.V.J.)

3659

CERTAIN ASPECTS OF PROTEINIC METABOLISM OF LIVER OBSERVED DURING RADIATION SICKNESS. N. V. Syromyatnikova. Doklady Akad. Nauk S.S.S.R. 111, 730-2 (1956) Nov. 21. (In Russian)

Studies were made of dissemination and urinary evolvement formation processes during various stages of radiation sickness. (R.V.J.)

3660

CHARACTERISTICS OF INFLAMMATORY SKIN RESPONSE IN IRRADIATED ANIMALS. A. E. Ivanov and V. F. Sosova. Med. Radiol. 1, No. 6, 24-30(1956) Nov.-Dec. (In Russian)

Studies were made of the pathological anatomic changes in the skin after injections of life culture of intestinal bacillus into rabbits exposed to total-body irradiation. (R.V.J.)

3661

ON RETENTION OF THE PROLIFERATIVE ABILITY OF SKIN EPITHELIUM DURING EXPOSURE TO LOCAL RADIATION. L. V. Funshteĭn (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, No. 6, 31-5(1956) Nov.-Dec. (In Russian)

3662

X-RADIATION EFFECTS ON DEVELOPMENT OF DIPHTHERIA ANTITOXIN. D. R. Kaulen (Gamaleĭ Inst. of Epidemiology and Microbiology). Med. Radiol. 1, No. 6, 51-6 (1956) Nov.-Dec. (In Russian)

3663

ON METHODS FOR REDUCING THE RADIOINDUCED LOCAL INJURIES RESPONSE. A. I. Ruderman, V. B. Zair-at'yants, and L. M. Sherman (Molotov State Research Inst. of Roentgenology and Radiology). Med. Radiol. 1, No. 6, 61-5(1956) Nov.-Dec. (In Russian).

3664

EFFECTS OF VARIOUS DOSES OF RADIOACTIVE PHOSPHORUS ON THE PROTEIN EXCHANGE. I. V. Savitskiĭ and A. F. Leshchinskiĭ (Odessa Pharmaceutical Inst.) Med. Radiol. 1, No. 6, 82-90(1956) Nov.-Dec. (In Russian)

3665

DNA SYNTHESIS AND INCORPORATION OF P^{32} IN IRRADIATED EHRLICH ASCITES CELLS. Lola S. Kelly, J. Dorothy Hirsch, Genevieve Beach, and Nicholas L. Petrakis (Univ. of California, Berkeley and Univ. of California Medical Center, San Francisco). Proc. Soc. Exptl. Biol. Med. 94, 83-6(1957) Jan.

3666

X-RAY IRRADIATION OF PREGNANT RATS: ATTEMPTS TO PRODUCE CONGENITAL CARDIAC ANOMALIES IN OFFSPRING. Ake Liljestrand and Jesse E. Edwards (Mayo Clinic and Mayo Foundation, Rochester, Minn.). Proc. Soc. Exptl. Biol. Med. 94, 111-12(1957) Jan.

3667

RELEASE OF POTASSIUM FROM THE X-IRRADIATED MAMMALIAN HEART. L. E. Ellinwood, J. E. Wilson, and J. M. Coon (Univ. of Chicago, Ill.). Proc. Soc. Exptl. Biol. Med. 94, 129-33(1957) Jan.

RADIATION HAZARDS AND PROTECTION

3668 AECU-3394

Sandia Corp., Albuquerque, N. Mex.

SOME HEALTH CONSIDERATIONS IN THE HANDLING OF TRITIUM. W. H. Kingsley and F. G. Hirsch. June 6, 1956. 5p. (TM-119-56-31). $1.80(ph OTS); $1.80(mf OTS).

A discussion is presented as to the possible hazards of tritium which may be used as a guide for those personnel who will be coming in contact with the material in small quantities. (auth)

3669 KAPL-1439

Knolls Atomic Power Lab., Schenectady, N. Y.

DETERMINATION OF RADIOACTIVE FALL-OUT. J. J. Fitzgerald. Feb. 9, 1956. 25p. Contract W-31-109-Eng-52. $0.25(OTS).

The origin, the quality, and the quantity of radioactive materials that may be discharged into the atmosphere are discussed. A distinction is made between deposition of activity on the ground by surface adsorption, fall-out, wash-out, and rain-out. The rate of deposition from wash-out is a factor of 4 to 20 times the rate of deposition during fall-out under similar circumstances. Rain-out deposition at a distance of one mile from the point where the activity is dispersed is a factor of 1000 greater than wash-out deposition. A formula for determining the accumulated external dose from the maximum deposition is given and is in good agreement with experimental data. (auth)

Refer also to abstract 3690.

RADIATION SICKNESS

3670
BIOCHEMICAL CHANGES IN LIVER FUNCTION DURING THE COURSE OF RADIATION SICKNESS. N. N. Blokhin, I. S. Luganova, and L. S. Rotfel'd (Research Inst. of Blood Transfusions). Med. Radiol. 1, No. 6, 40-6(1956) Nov.-Dec. (In Russian).

3671
ALTERATIONS IN ADENOSINE TRIPHOSPHATASE ACTIVITY DURING ACUTE AND SUBACUTE RADIATION SICKNESS. E. A. Prokudina (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, No. 6, 46-51(1956) Nov.-Dec. (In Russian)

RADIOTHERAPY

3672
RADIO COBALT NEEDLES IN THERAPY. G. G. Binnie and Norman Bates (Stoke-on-Trent Regional Radium Center, Hartshill). Intern. J. Appl. Radiation Isotopes 1, 314(1957) Jan.

3673
INVESTIGATIONS OF RADIOACTIVE METHIONINE EFFECTS ON RETARDING THE GROWTH OF SARCOMA IN ANIMALS. I. G. Spasskaya (Inst. of Experimental Pathology and Therapy of Cancer). Med. Radiol. 1, No. 6, 74-7(1956) Nov.-Dec. (In Russian)

TRACER APPLICATIONS

3674 UR-480
Rochester, N. Y. Univ. Atomic Energy Project.
THE METABOLISM OF THORIUM^{230} (IONIUM) ADMINISTERED BY INTRATRACHEAL INJECTION TO THE RAT. Robert G. Thomas. Dec. 10, 1956. 30p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Thorium^{230} (ionium) is found to be excreted in only negligible or very small quantities in urine after intratracheal injection. Occasional samples had measurable activity, but the insolubility of thorium in body fluids is very evident from the small amounts found in all tissues (except lung). Further, any ionium that is excreted in urine appears to follow a rather random pattern with time, bearing no relationship to lung or body burden. The critical organ for the calculation of an MPC for any ordinary thorium compound entering the body through the respiratory system appears to be the lung. This, however, is based upon a single intratracheal administration and does not necessarily apply to the case of chronic exposure to atmospheres containing thorium. Practically all of the ionium which does enter the circulation from the respiratory tract localizes in the skeleton. It appears that analyzing feces for thorium in the first week following a single exposure has good possibilities for use as a determination of lung or body burden. (auth)

3675 USNRDL-TR-119
Naval Radiological Defense Lab., San Francisco.
UPTAKE OF FISSION PRODUCTS AND NEUTRON-INDUCED RADIONUCLIDES BY THE CLAM. J. K. Gong, W. H. Shipman, H. V. Weiss, and S. H. Cohn. Nov. 27, 1956. 19p. Project NM-006-0.15.04.

A study of the uptake of three neutron-induced radionuclides (Zn^{65}, Fe^{59}, and Co^{58}) and a two-month old mixture of fission products by the clam demonstrated the ability of this marine animal to rapidly concentrate significant quantities of these radionuclides in both the shell and soft tissue. The uptake of radioactive material in the soft tissue is a metabolic incorporation, while the higher uptake by the shell appears to be a surface adsorption phenomenon. The rate of incorporation by the soft tissues was constant and was highest for the rare earth group of fission products. Uptake of Co^{60}, Zn^{65}, and Fe^{59} were also constant but occurred at a much lower rate. Sr^{89} and $Ru^{103-106}$ were taken up only in equilibrium with the radioactive medium in the experimental interval studied. Further study with the radionuclide Co^{60} indicated that the rate of uptake varied as a power function with the level of concentration of the radionuclide in the medium. The ability of the clam to concentrate radioelements to a high degree makes it valuable as a biological indicator of radioactivity. It may be particularly useful in assessing the contamination of marine areas with low levels of radioactivity. (auth)

3676
THYROID FUNCTION IN FETAL SHEEP. C. M. Barnes, D. E. Warner, S. Marks, and L. K. Bustad (General Electric Co., Richland, Wash.). Endocrinology 60, 325-8(1957) Feb.

Initial thyroid uptake of I^{131} was demonstrated in sheep fetuses on the 50th day of gestation, using radioanalytical and autoradiographic methods. The formation of thyroid follicles was first observed histologically on the 52nd day of gestation. The onset of iodine uptake at the beginning of the second trimester of pregnancy in sheep corresponds to the reported time of earliest I^{131} uptake in the human thyroid and occurs substantially earlier than previously reported for sheep. (auth)

3677
A METHOD FOR TRITIATED WATER DOSAGE AND ITS APPLICATIONS IN CLINICAL PRACTICE. P. Fallot, A. Aeberhardt, and J. Masson. Intern. J. Appl. Radiation Isotopes 1, 237-45(1957) Jan. (In French)

A rapid and sensitive method is presented for the determination of tritiated water dosage in biological liquids. The radioactivity is measured with an ionization chamber after conversion of water to gaseous hydrogen by means of calcium. (C.H.)

3678
TECHNIQUES FOR PERNICIOUS ANEMIA DIAGNOSIS WITH RADIOCYANOCOBALAMIN. D. L. Tabern and Robert Storey (Abbott Labs., North Chicago, Ill.). Intern. J. Appl. Radiation Isotopes 1, 249-55(1957) Jan.

This paper represents an attempt to delineate the optimal conditions for the use of cobalt-labelled B_{12} in the diagnosis of pernicious anemia and in the testing of intrinsic factor samples. Data presented indicate that the optimal amount of total B_{12} administered should be something of the order of 0.5 to 0.7 μg, with the activity used running between 0.1 and 0.5 μc, depending upon specific counting setup. A very simple arrangement for counting a liter of the urine avoids the necessity for evaporation or concentration of samples. In testing the intrinsic factor, levels used should preferably be on the under side of what is clinically regarded as a clinically effective dose. Data thus secured seem to be in

agreement with the official clinical response test, and particularly if subsequent flushing doses are employed in questionable cases, the test would seem to pose no significant hazard to the patient or individual being used for clinical evaluation. (auth)

3679

COMPARATIVE METABOLISM OF Sr^{89} AND Ca^{45} BY BONE GROWN IN VITRO. F. W. Lengemann (Univ. of Tennessee, Memphis). Proc. Soc. Exptl. Biol. Med. 94, 64-6(1957) Jan.

3680

RADIOISOTOPES IN THE STUDY OF MINERAL METABOLISM. C. L. Comar and R. H. Wasserman (Oak Ridge Inst. of Nuclear Studies, Tenn.). Progr. Nuclear Energy, Series VI, Biol. Sci. 1, 153-96(1956).

Certain aspects of skeletal physiology and the metabolism of calcium, strontium, and iodine are reviewed. Emphasis is given to recent developments arising primarily from the use of radioisotopes in these areas of research. The subject matter is considered and integrated from two points of view: the fundamental physiology and nutrition involved and the problems arising from the potential health hazards of the fission products. It now appears that we have a reasonable understanding of what happens under varying conditions to these radioisotopes after they enter the body. Also, it is possible to estimate the retention by man and the entrance into edible products of the animal when the dietary intake is known. (83 references) (auth)

CHEMISTRY

3681 CCC-1024-TR-218

Boston Univ.

MEASUREMENT OF SOME THERMODYNAMIC FUNCTIONS OF ALKALI METAL BOROHYDRIDES IN LIQUID AMMONIA. L. V. Coulter, J. B. Sinclair, A. G. Cole, I. Warshawsky, and M. Wolfe. Jan. 7, 1957. 10p. For [Callery Chemical Co.]. Contract [NOa(s)-52-1024-c].

The heats of solution of Li, Na, K, and Rb borohydrides in liquid NH_3 at −33°C are −21.3, −9.90, −1.33, and −0.6 kcal, respectively. The heat of formation of the borohydride ion in liquid NH_3 is −17.2 kcal. From the known heats of formation of the ions and the measured heats of solution, the heats of formation of solid K and Rb borohydride were found to be −55.5 and −56.6 kcal. These values agree with lattice-energy calculations. The free energy of formation of the borohydride ion in NH_3 was calculated, from the free energy of solution of sodium borohydride diammoniate and the free energy of solution of Na^+, to be 6.2 kcal for the hypothetical one molal solution. The partial molal entropy of the borohydride ion is −18.4 cal deg^{-1} $mole^{-1}$. The values for the heat of solvation of the gaseous borohydride ion and for the ionic entropy of the ammoniated borohydride ion are consistent with the thermodynamic properties expected for a negative monovalent ion of about the radius of the borohydride ion. (auth)

3682 NAA-SR-1771

Atomics International Div., North American Aviation Inc., Canoga Park, Calif.

THE BEHAVIOR OF TETRALIN IN LIQUID SODIUM. R. L. McKisson and K. E. Horton. Feb. 1, 1957. 19p. Contract AT(04-3)-49. $0.20(OTS).

A simplified, nonequilibrium experiment designed to qualitatively study the behavior of tetralin i.e., rate of reaction or decomposition in the presence of sodium, at temperatures up to 950°F has been performed to establish the probable consequences of a tetralin leak in the Sodium Reactor Experiment. It was found that tetralin decomposes with rapidity in the presence of hot liquid sodium. The ultimate decomposition products are hydrogen, carbon, and low molecular weight aliphatic compounds. The hydrogen is rapidly absorbed by the hot sodium up to approximately 750°F. At higher temperatures, sodium tends to release hydrogen. Zirconium metal submerged in sodium irreversibly absorbs hydrogen, at least up to 950°F, so that most of the hydrogen resulting from tetralin decomposition in the SRE ultimately would be absorbed in the zirconium moderator can sheaths. The carbon would circulate in the sodium, so that very slight carburization of the stainless might be expected with operation at 950°F. The hydrocarbon residues will collect in the gas space over the sodium pool and eventually decompose. (auth)

3683

THE INVESTIGATION OF VARIOUS CHEMICAL SYSTEMS BY ELECTRON-SPIN RESONANCE. D. J. E. Ingram. Analyst 81, 681-7(1956) Dec.

The application of electron-resonance techniques to the study of different chemical problems is briefly outlined. Although the most direct use of this technique in chemical analysis is for the determination of very small concentrations of paramagnetic atoms, it can also be applied to a large number of other systems that normally contain unpaired electrons or can be easily made to do so. The general conditions governing its applicability are first outlined and then some of the more important cases, such as photochemical reactions, irradiation chemistry and the like, are treated in some detail. The type of chemical information that can be obtained in each case is also summarized and particular importance is attached to the hyperfine-structure analysis, which can often give a wealth of chemical data. (auth)

3684

POLARIZATION OF THORIATED OXIDE CARBON ANODES IN MELTED CHLORIDES AT LOW CURRENT DENSITIES. M. V. Smirnov, N. Ya. Chukreev, and L. E. Ivanovskiĭ (Ural Acad. of Science, Electrochemical Laboratory). Doklady Akad. Nauk S.S.S.R. 110, 1022-5(1956) Oct. 21. (In Russian)

3685

ISOTOPIC FRACTIONATION IN THE SYSTEM IODINE CYANIDE/CYANIDE BY A COMBINED EQUILIBRATION-PRECIPITATION PROCESS. F. E. Jenkins and G. M. Harris (Univ. of Buffalo, N. Y.). J. Am. Chem. Soc. 79, 276-7(1957) Jan. 20.

The equilibrium constant for the reaction $CNI + C^{14}N^- \rightleftharpoons C^{14}NI + CN^-$ as predicted by statistical thermodynamics is K = 1.05 at 30°. The experimental values obtained by examination of the activity of precipitated silver cyanide are always larger than the predicted value, and vary with the composition of the dioxane-water solvent used. The results can be interpreted quantitatively in terms of a combination of isoptope effects in the equilibration and precipitation reactions. (auth)

3686

DIFFUSION OF RADIOACTIVE MAGNESIUM IN MAGNESIUM OXIDE CRYSTALS. Roland Lindner and Geoffrey D. Parfitt (Indiana Univ., Bloomington). J. Chem. Phys. 26, 182-5 (1957) Jan.

The diffusion of Mg^{28} in crystal plates of MgO has been measured. Between 1400 and 1600°C the temperature function of the diffusion coefficient can be represented by the relation $D = 0.249 \exp(-79.0 \text{ kcal/RT}) \text{ cm}^2 \text{ sec}^{-1}$. (auth)

3687

STUDIES ON HOMOGENEOUSLY PRECIPITATED AND SUPPORTED PEROXIDES OF ZIRCONIUM, THORIUM AND OTHER POLYVALENT CATIONS. Delbert C. Gantz and

Jack L. Lambert (Kansas State Coll., Manhattan). J. Phys. Chem. 61, 112-14(1957) Jan.

The preparation and some properties of the peroxides of Th and Zr are given. (T.R.H.)

3688

ELECTRICAL CONDUCTANCE IN MOLTEN SALT MIXTURES. Benson R. Sundheim (New York Univ., New York). J. Phys. Chem. 61, 116-17(1957) Jan.

The electrical conductivities of molten NaCl–KCl, LiCl–KCl, and KI–KCl systems are measured and discussed. (T.R.H.)

AEROSOLS

3689

RADIOACTIVE AEROSOLS. G. L. Natanson. Uspekhi Khim. 25, 1429-45(1956) Dec. (In Russian)

Tabulations are given presenting various published data on safe atmospheric concentrations of various radioactive and non-radioactive aerosols. Methods of determination of active aerosol concentrations and dispersion as well as the technical applications of "labeled" aerosols are discussed. The effects of atomic explosions are analyzed considering the "nominal" atomic bomb based on U^{235} and Pu^{239} equivalent to 20,000 tons of TNT. (R.V.J.)

ANALYTICAL PROCEDURES

3690 AECU-3297

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies.

PROJECT SUNSHINE BULLETIN NO. 12. E. A. Martell. Aug. 1, 1956. 62p. Contract AT(11-1)-281. $0.40(OTS).

Results obtained since Dec. 1, 1955 are presented for Sr^{90} analyses of samples of biological materials. Data are tabulated on fresh milk and cheese, soil samples, rain, snow, and surface waters, and air filters collected from various parts of the world. The data for biological and soil samples are presented in units of 1/1000 of the maximum permissible tolerance of Sr^{90} in human bone for an average man of 1000 grams total body content of Ca. Thus, the Sunshine unit is 1/1000 μc of Sr^{90} per 1000 grams of Ca or 2.2 disintegrations per min per gram of Ca. Results for water and air samples are reported in disintegrations per min of Sr^{90} for convenient reference sample volume. (C.H.)

3691 AERE-C/M-109

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

MEASUREMENT OF BUTEX ACIDITY BY ELECTRICAL CONDUCTIVITY. T. V. Healy and H. A. C. McKay. May 9, 1951. Decl. Dec. 20, 1956. 5p. (PWP(P)-13A).

The method is satisfactory down to 1N except with respect to impurities in the solvent. (auth)

3692 AERE-C/R-874

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN EXPERIMENTAL DETERMINATION OF THE SPECIFIC ACTIVITY AND ISOTOPIC CONTENT OF A PLUTONIUM SAMPLE. G. R. Hall and A. J. Walter. Dec. 17, 1951. Decl. Nov. 6, 1956. 17p.

3693 AERE-C/R-1654

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ANALYSIS OF ZIRCONIUM–CERIUM BINARY ALLOYS. G. W. C. Milner and G. W. Sneddon. July 11, 1955. 14p.

A suitable procedure is described for the analysis of Ce–Zr alloys containing from 1 to 99% of either constituent. A solution of the alloy is produced by treating sample turnings initially with HCl (1 : 1), then by HF dropwise. This solution is evaporated to fumes of H_2SO_4 to remove F^- and Cl^- and it is then diluted to a suitable volume. Cerium is determined on an aliquot by oxidation with $(NH_4)_2S_2O_8$ and subsequent titration with a standard solution of ferrous ammonium sulfate, ferroin being used as the indicator. Zr is also determined volumetrically on a separate aliquot by adding a small excess of EDTA and titrating this excess with a standard solution of ferric iron. Interference from cerium is avoided by titrating in solutions at pH 2.2 and the end point is determined photometrically using potassium benzohydroxamate as the indicator. This procedure avoids chemical separations since neither element interferes with the determination of the other. (auth)

3694 AERE-C/R-1740

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ANALYSIS OF THORIUM–CERIUM BINARY ALLOYS. G. W. C. Milner and G. W. Sneddon. Sept. 1955. 17p.

A procedure is described for the analysis of Th–Ce alloys containing from 1 to 99% of either constituent. The majority of the alloy is dissolved in HCl and any insoluble, residue is fused with $KHSO_4$. The alloy solution is then evaporated to fumes of $HClO_4$ and after cooling it is diluted to a suitable volume with H_2O. The Ce is determined on a suitable aliquot by oxidation with $(NH_4)_2S_2O_8$ followed by titration with $FeSO_4 \cdot (NH_4)_2SO_4$, using ferroin as the indicator. Thorium is determined on another aliquot by adding a small excess of EDTA and titrating this excess with a standard $Th(ClO_4)_4$ solution. Interference from Ce is avoided by titrating at pH 2.2 and the end point is determined photometrically using eriochrome cyanine as the indicator. This procedure avoids chemical separations. (auth)

3695 BM-RI-5282

Bureau of Mines.

A RAPID METHOD FOR FLUOROMETRIC DETERMINATION OF BERYLLIUM. J. M. Riley. Apr. 1956. 11p.

A fluorometric method using morin in an alkaline-buffered chelating solution has been developed for determining Be in ores and mill products. Apparatus for measuring fluorescence intensities of the Be–morin reaction is described. Preparation of the sample for analysis consists essentially of digestion with H_2SO_4, HNO_3, and HF acids, fusion of the residue with sodium carbonate and sodium borate, solution of the melt with HNO_3, and proper dilution. Chemical separation of other ions is usually unnecessary. The method gave reliable Be determinations on samples in the 0.01- to 0.37% BeO range. The method is particularly applicable to low-grade Be ores; however, semiquantitative Be determinations have been made on beryl containing 12.0% BeO. (auth)

3696 JENER-46

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

SOME ANALYTICAL METHODS USED IN CONNECTION WITH THE CHEMICAL SEPARATION OF PLUTONIUM. T. Sikkeland and J. Haaland. Dec. 19, 1956. 12p.

Analytical methods used in work with the chemical separation of Pu on a laboratory scale are presented. They include chemical reactions for the identification of the element, analysis of its chemical state, determination of its concentration and analysis of impurities in the product. (auth)

3697 KAPL-1477

Knolls Atomic Power Lab., Schenectady, N. Y.

SELECTED METHODS OF CHEMICAL ANALYSIS FOR THOREX PROCESS CONTROL. W. W. Sabol and B. F.

Rider. Sept. 1, 1956. 77p. Contract W-31-109-Eng-52. $0.45(OTS).

Step-by-step procedures for control of the Thorex process miniature pilot plant at KAPL are given for use as a laboratory manual. Included are procedures for measuring acidity, density, Th content, radiation (α,β, and γ), U^{233} and U^{232}. General radiochemical procedures are given for determination of Ce^{144}, Cs^{137}, Pa^{233}, Ru^{106}, Sn^{89}, Th^{234}, total rare earths (TRE) and Zr^{95} + Nb^{95}. Miscellaneous determinations cover n-butanol, DBP, F^-, fluorimetric U, MnO_2, Mn, PO_4^-, TBP, and unstable constituents in TBP diluent. (auth)

3698 KAPL-M-JR-9

Knolls Atomic Power Lab., Schenectady, N. Y.

CHEMICAL ANALYSIS OF TRACES OF PLATINUM IN 7% URANIUM–ZIRCONIUM. V. F. Consalvo and J. Rynasiewicz. Jan. 24, 1957. 6p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A procedure has been developed for the analysis of Pt in a 7% U–Zr alloy containing approximately 0.30% Pt. Fine metal chips from the alloy were dissolved in HF acid and H_2O. Nitric acid was added to complete the dissolution of the Zr and U. The acid insoluble Pt was ashed and then dissolved in aqua regia. The solution was evaporated to dryness, filtered and dissolved in HCl acid. The Pt was determined colorimetrically by the $SnCl_2$ method. (auth)

3699 MCC-1023-TR-211

Olin Mathieson Chemical Corp., Baltimore.

MASS SPECTRUM AND VAPOR PRESSURE OF DEUTEROPENTABORANE. I. Shapiro and J. F. Ditter. Oct. 29, 1956. 18p. Project ZIP. Contract NOa(s)-5[2]-1023-c.

The complete mass spectrum of pentaborane-d_9 and a partial mass spectrum of pentaborane-d_8 have been calculated from the spectra of a series of samples of different hydrogen content. The vapor pressure for pentaborane-d_9 containing 3.9% of the B_5 D_8H species can be expressed by the equation $\log_{10}P_{mm} = 9.469155 - 0.002878300T - 1870.703/T$ over the temperature range of −25 to +56°C The melting point is −47°C. (auth)

3700 ORNL-2211

Oak Ridge National Lab., Tenn.

DETERMINATION OF MICROGRAM QUANTITIES OF CARBON BY LOW-PRESSURE COMBUSTION. J. H. Edgerton and H. G. Davis. Jan. 29, 1957. 12p. Contract W-7405-eng-26. $0.20(OTS).

The determination of microgram quantities of C in alloys by the low-pressure combustion method is based on the combustion of the specimen in O_2 at 135 mm pressure, freezing out the CO_2, pumping out the excess O_2, and then measuring the CO_2 in the gas phase with a known volume by means of a McLeod gage. The recommended concentration range is from 0.003 to 0.3 mg of C in a 0.3-gram sample, i.e., from 0.001 to 0.1% C. The relative standard deviation of the method is 10%. The unique features of the apparatus is the use of a Toepler pump to transfer the CO_2 to the McLeod gage. (auth)

3701 UCRL-3499

California. Univ., Berkeley. Radiation Lab.

IONIZATION CHAMBER ASSAY OF RADIOACTIVE GASES. B. M. Tolbert. Mar. 5, 1956. 47p. Contract W-7405-eng-48. $0.35(OTS).

A practical review is presented on ionization-chamber assay of radioactive gases. The subjects covered include: ion chamber theory, samples and sample preparation, combustion of organic compounds to CO_2, design and construction of ion chambers, measurement of ion chamber currents and approximate calibration data, and detailed procedures for C^{14} and tritium assay. (auth)

3702 USNRDL-TR-117

Naval Radiological Defense Lab., San Francisco.

SEQUENTIAL ANALYSIS OF TRACER AMOUNTS OF Np, U, AND Pu IN FISSION-PRODUCT MIXTURES BY ANION EXCHANGE. L. Wish and M. Rowell. Oct. 11, 1956. 34p. Project NS 081-001.

Elution characteristics of Np, Pu, U and Zr in HCl, HNO_3 and H_2SO_4 media with Dowex-2 anion resin were found. From these a procedure for the sequential analysis of the three actinides in fission-product mixtures in HCl and HNO_3 has been developed. Protactinium has also been included in the separation scheme. In most cases the Np, Pa and Pu were sufficiently decontaminated after one column for 99% purity. The U contained a large portion of the Zr and had to be treated further for a satisfactory separation. The yields were approximately 70 to 90%. (auth)

3703 WADC-TR-56-300

Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.

TANTALUM DETERMINATION. Technical Report No. 1. Ross W. Moshier and James E. Schwarberg. June 1, 1956. 38p. Project title: ANALYTICAL CHEMISTRY OF SPECIAL ALLOYING METALS. (AD-97194).

Studies on the organic reagents N-nitrosophenylhydroxylamine and N-benzoylphenylhydroxylamine for precipitation of metals has lead to the development of methods of separation of Mo plus W from Ta, Nb, Ti, and Zr; and a method of subsequent separation of Ta from Nb, Ti, and Zr and its quantitative determination. Control of acidity, HF concentration, and temperature are required. Two precipitations of the Ta by N-benzoylphenylhydroxylamine are required to obtain the analytically pure Ta compounds. (auth)

3704 AEC-tr-2814

NEPHELOMETRIC DETERMINATIONS. E. Canals and A. Charra. Translated by K. S. Bevis from Bull. soc. chim. France 12, 89-91(1945). 4p.

The nephelometric determination of $BaSO_4$ is described and discussed. (T.R.H.)

3705

DETERMINATION OF RARE EARTH ELEMENTS AND THORIUM IN MAGNESIUM WITH PHOTOELECTRIC RECORDING SPECTROMETER. E. J. Hunemorder and T. M. Hess (The Dow Chemical Co., Midland, Mich.). Anal. Chem. 29, 236-8(1957) Feb.

A spectroscopic method was developed to provide a rapid and accurate means of determining the concentrations of Ce, La, Pr, Nd, and Th. Self-electrodes are sparked directly using high-voltage spark excitation. The spectral line intensities are recorded photoelectrically for analysis. The influence of the metallurgical history of the sample is negligible. Alloy environment is important in the Ce and Th determinations. (auth)

3706

VACUUM FUSION DETERMINATION OF OXYGEN AND NITROGEN IN LANTHANUM. D. T. Peterson and D. J. Beerntsen (Iowa State Coll., Ames). Anal. Chem. 29, 254-7(1957) Feb.

The vacuum fusion technique was modified to permit analysis of La metal. The La sample was dropped into a Ni bath and heated to 1900°C. The average recovery of added O_2 was 90.9%, with a probable error of 1.7%. The loss of approximately 9% of this added O_2 was probably due to adsorption by the vaporized Ni. The analysis was completed by a mass spectrometric determination of the composition of the evolved gas. (auth)

3707

ON THE SUBTRACTION OF GAMMA-RAY SPECTRA AS A TOOL IN RADIACTIVATION ANALYSIS. J. L. Putman

and W. H. Taylor (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Intern. J. Appl. Radiation Isotopes 1, 315-16(1957) Jan.

3708
RADIOCHEMICAL PROCEDURE FOR INDIVIDUAL RARE EARTHS. L. R. Bunney, E. C. Freiling, L. D. McIsaac, and E. M. Scadden (Naval Radiological Defense Lab., San Francisco, Calif.). Nucleonics 15, No. 2, 81-3(1957) Feb.

A procedure is given for the separation and radiochemical determination of the rare earths and Y which occur as fission products of U^{235}. (T.R.H.)

Refer also to abstract 3905.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

3709
THE CRYSTAL STRUCTURE OF THE P PHASE, Mo–Ni–Cr. II. REFINEMENT OF PARAMETERS AND DISCUSSION OF ATOMIC COORDINATION. David P. Shoemaker, Clara Brink Shoemaker, and Frank C. Wilson (Massachusetts Inst. of Tech., Cambridge, Mass.). Acta Cryst. 10, 1-14(1957) Jan.

3710
THE PREDICTION OF TWINNING MODES IN METAL CRYSTALS. M. A. Jawson and D. B. Dove (Imperial Coll., London, Eng.). Acta Cryst. 10, 14-18(1957) Jan.

A new crystallographic analysis of deformation twinning in multiple lattices is developed. This enables the operative twinning modes to be predicted for all metal crystals, including α-U. Reasons are given for the non-appearance of certain modes expected theoretically. (auth)

3711
THE CRYSTAL STRUCTURES OF THE TRIFLUORIDES OF IRON, COBALT, RUTHENIUM, RHODIUM, PALLADIUM, AND IRIDIUM. M. A. Hepworth, K. H. Jack, R. D. Peacock, and G. J. Westland (King's Coll., Newcastle-on-Tyne, Eng.). Acta Cryst. 10, 63-9(1957) Jan.

The structures of FeF_3, CoF_3, RuF_3, RhF_3, PdF_3, and IrF_3 are rhombohedral with atoms in the following special positions of space group $R\bar{3}c$: 2M at 0, 0, 0; $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, and 6F at $\pm(x, \frac{1}{2}-x, \frac{1}{4})$; $\pm(\frac{1}{2}-x, \frac{1}{4}, x)$; $\pm(\frac{1}{4}, x, \frac{1}{2}-x)$. For IrF_3, PdF_3 and RhF_3, $x = -0.083 \pm 0.003$; i.e., $x = -\frac{1}{12}$ within experimental error. For RuF_3, $x = -0.100 \pm 0.005$; for CoF_3, $x = -0.15 \pm 0.01$; and for FeF_3 $x = -0.164 \pm 0.003$. In each case, direct experimental evidence shows that the structural unit is not the unimolecular rhombohedron proposed for some of these trifluorides by earlier workers. Regular or almost regular octahedra of fluorine atoms, each with a metal atom at its center, are joined by sharing corners only. The fluorine-atom arrangement is hexagonal close-packed in RhF_3, PdF_3 and IrF_3; for the other three trifluorides the distortion from hexagonal close-packing increases in the order RuF_3, CoF_3, FeF_3. Relationships between the different structures typified by MoF_3, VF_3 and PdF_3 respectively, are discussed. RuF_3, and to a smaller extent IrF_3, both show variabilities in their unit-cell dimensions which, it is claimed, are due to variations from the stoichiometric composition caused by the presence in the lattice of cations with valencies other than three. (auth)

3712
A SINGLE-CRYSTAL NEUTRON DIFFRACTION STUDY OF HEAVY ICE. S. W. Peterson and Henri A. Levy (Oak Ridge National Lab., Tenn.). Acta Cryst. 10, 70-6(1957) Jan.

Neutron diffraction measurements of the hol reflections of crystalline D_2O at −50 and −150° C. are consistent with the disordered model of Pauling. The O–D distances are both 1.01 A and the D–O–D angles are close to tetrahedral. Analysis of the thermal parameters resulting from a complete least-squares refinement of the structure clearly demonstrates anisotropy of deuterium motion, and yields values for the amplitude of the O–D stretching vibration consistent with frequency of this motion. (auth)

3713
NEW ATOMIC FORM FACTORS FOR BERYLLIUM AND BORON. James A. Ibers (Shell Development Co., Emeryville, Calif.). Acta Cryst. 10, 86(1957) Jan.

3714
CRYSTALLOGRAPHIC DATA: DIURANYL CHROMATE URANIUM TRIOXIDE TETRAHYDRATE, $2UO_3CrO_4.UO_3.4H_2O$. R. M. Douglass and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 314-15(1957) Feb. NIOBIUM PENTACHLORIDE, $NbCl_5$. R. M. Douglass and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 315-16(1957) Feb. COPPER MONOCYANIDE, CuCN. D. T. Cromer, R. M. Douglass, and Eugene Startizky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 316(1957) Feb.

DEUTERIUM AND DEUTERIUM COMPOUNDS

3715 AERE-ED/D-52
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PHYSICAL PROPERTIES OF HEAVY WATER. Oct. 19, 1955. 5p.

3716 CF-55-2-119
Oak Ridge National Lab., Tenn.
HRP-CP: D_2O DECOMPOSITION IN CHEMICAL PLANT FROM BETA AND GAMMA RADIATION. W. L. Carter. Feb. 17, 1955. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

3717 NYO-889(Del.)
Hydrocarbon Research Inc., New York.
FINAL REPORT TO U. S. ATOMIC ENERGY COMMISSION; LOW-TEMPERATURE HEAVY WATER PLANT. Mar. 15, 1951. Changed from OFFICIAL USE ONLY with deletions Jan. 21, 1956. 102p. Contract AT(30-1)-810. $18.30(ph OTS); $6.00(mf OTS).

The design of a low-temperature plant for the production of heavy water by the distillation of ammonia synthesis gas is presented. (W.L.H.)

3718 AEC-tr-2808
THE PRODUCTION OF HEAVY WATER. (Die Herstellung von Schwerem Wasser.) E. W. Becker. Translated from Angew. Chem. 68, 6-13(1956). 27p.

3719
ON TWO MECHANISMS OF HYDROGENATION AND EXCHANGE BETWEEN ETHYLENE AND DEUTERIUM ON PALLADIUM. V. B. Kazanskiĭ and V. V. Voevodskiĭ (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 111, 125-8(1956) Nov. 1. (In Russian)

Investigations of ethylene–deuterium interaction over palladium revealed that the reaction proceeds according to different mechanisms (processes) at high and low temperatures. (R.V.J.)

Refer also to abstract 3712.

FLUORINE AND FLUORINE COMPOUNDS

3720 UCRL-3567
California. Univ., Berkeley. Radiation Lab.
NUCLEAR MAGNETIC RESONANCE STUDIES OF SOME INORGANIC MOLECULES AND IONS (thesis). Richard Edwin Poulson. Nov. 16, 1956. 59p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

The F^{19} nuclear magnetic-resonance spectra of several

aqueous complex metallic fluoride systems have been studied. The spectrum of an equimolar aluminum nitrate–sodium fluoride solution consists of two closely spaced lines that are attributed to AlF_2^+ and AlF^{+2} ions. The fluoride exchange time for these ions in solution of M aluminum nitrate and M sodium fluoride at room temperature is estimated to be greater than 8 milliseconds. The chemical shifts of these ions are approximately equally dependent on the sodium ion concentration. The separation between the lines is increased by nitric acid, but decreased by sodium nitrate or sodium perchlorate and possibly by sodium hydroxide. This effect could not be attributed to a change in the fluoride exchange time on the basis of the data available. Chemical shifts for fluoride ion in dilute solutions of either sodium fluoride or potassium fluoride were found to be concentration-dependent and opposite in sign. The nuclear magnetic shielding of F^{19} in potassium fluoride solutions has a minimum at about 5M potassium fluoride and from there rapidly increases with concentration. The minimum time for exchange of fluoride ion in certain solutions has been estimated for each of the following aqueous systems: TiF_n^{+4-n}, F^-; ZnF^+, F^-; SiF_6^{-2}, $HF-F^-$; and SnF^+, $HF-F^-$. Resonances attributed to AgF, UO_2F^+, and ThF^{+3} have been observed. A correlation of the fluoride chemical shift of a complex with the atomic number of the atom bonded to fluorine divided by the interatomic distance in the fluoride complex is more satisfactory than an attempted electronegativity correlation. (auth)

3721 WADC-TR-56-4(Pt. II)

Stanford Research Inst., Menlo Park, Calif.

THE THERMODYNAMIC PROPERTIES OF MOLTEN SALTS. PART II. TUNGSTEN HEXAFLUORIDE, NIOBIUM PENTAFLUORIDE, AND VANADIUM TRIFLUORIDE. [Period Covered] November 1955 to September 1956. Orlo E. Myers. Sept. 1956. 55p. Project No. 1252. Contract AF33(616)-2558.

Assembly and adjustment of apparatus for measuring enthalpies from 50 to 1200°C has been completed. A new solution calorimeter suitable for use with metallic ampoules for measurements with fluorides has been constructed. An improved low temperature calorimeter has been built with the aid of electroforming techniques. This equipment has been used in conjunction with low-temperature equipment previously described to obtain thermodynamic data for WF_6, NbF_5, and VF_3. (auth)

3722 RAE-Lib/Trans-564

THE ELECTROCHEMICAL FLUORINATION OF INORGANIC COMPOUNDS: ANODIC FORMATION OF SULPHURYL FLUORIDE. (Uber die Elektrochemische Fluorierung Anorganischer Versindungen: Anodische Bildung von Sulfurylfluorid). H. Schmidt and H. D. Schmidt. Translated by B. E. C. Jenkins from Z. anorg. u. allgem. Chem. 279, 289-99(1955). 13p. (AD-102103).

The anode reactions which may occur in the electrolysis of fluorides are described and discussed, with special reference to the anodic secondary reaction which is the basis of the process of electrochemical fluorination. The findings of a number of workers in this field are quoted and discussed. Anode reactions occurring in the electrolysis of H_2O/HF and NH_3/HF systems are discussed in detail, with references. Finally, some experimental work on the preparation of sulfuryl fluoride by the electrochemical fluorination of fluorosulfonic acid is described. (auth)

3723 RAE-Lib/Trans-571

ELECTROCHEMICAL FLUORINATION. PART II. INVESTIGATION INTO THE ANODE REACTIONS TAKING PLACE DURING THE ELECTROLYTIC FLUORINATION OF CARBOXYLIC ACIDS IN HYDROGEN FLUORIDE. (Elektrochemische Fluorierung. II. Untersuchung der Anodenvorgänge bei der Elektrolytischen Fluorierung von Carbonsäuren in Fluorwasserstoff). H. Schmidt and H. D. Schmidt. Translated by B. E. C. Jenkins from J. prakt. Chem. (4), 2, 105-120(1955). 17p. (AD-102107).

In order to investigate the anode reactions in electrochemical perfluorination by Simons' technique, a series of the lower carboxylic acids were electrolyzed in HF, to the stage of monofluorination. The results illustrate the complex character of the anode reactions and enable them to be approximately defined. The influence of water on the electrofluorination, and the possible attack on the anode are discussed. Several causes are given for the hitherto unexplained low fluorine yield. Also discussed are: the breaking of the C-C bond in the secondary reaction; the instability of some fluorinated products; the anodic oxidation of the organic substance to be fluorinated; and the re-formation of HF due to the presence at the anode of H_2 evolved at the cathode. (auth)

3724 RAE-Lib/Trans-574

ELECTROCHEMICAL FLUORINATION. PART III. ELECTROFLUORINATION OF OLEFINES IN NON-AQUEOUS SOLVENTS; THE MECHANISM OF THE ANODE REACTIONS. (Elektrochemische Fluorierung. III. Elektrofluorierung von Olefinen in Nichtwässrigen Lösungsmitteln; Zum Mechanismus des Anodenvorganges). H. Schmidt and H. D. Schmidt. Translated by B. E. C. Jenkins from J. prakt. Chem. (4), 2, 250-60(1955). 13p. (AD-102475).

3725

THE THERMODYNAMIC PROPERTIES OF AMMONIUM FLUORIDE: HEAT CAPACITY FROM 6 TO 309°K., THE ENTROPY, ENTHALPY AND FREE ENERGY FUNCTION. Edwin Benjamins and Edgar F. Westrum, Jr. (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 79, 287-90 (1957) Jan. 20.

Measurements of the heat capacity of NH_4F have been made by adiabatic calorimetry over the range 6 to 309°K. In contrast with the reports by others of a hump in the heat capacity near 240°K., no thermal anomaly was found in the entire range of measurement. The molal heat capacity and the derived molal entropy and enthalpy at 298.16°K. are 15.60 ± 0.02 cal./deg., 17.20 ± 0.02 cal/deg., and 2655 ± 3 cal., respectively. (auth)

3726

ON THE DYNAMIC-MECHANICAL PROPERTIES OF POLYETHYLENE AND POLYTETRAFLUOROETHYLENE. S. P. Kabin (Kalinin Leningrad Polytechnic Inst). Zhur. Tekh. Fiz. 26, 2628-32(1956) Dec. (In Russian)

Dynamic-mechanical properties of polyethylene and polytetrafluoroethylene of various degrees of crystallinity were studied in relation to temperature at various frequencies. (R.V.J.)

Refer also to abstracts 3711 and 4003.

GRAPHITE

3727 HW-37406

Hanford Atomic Products Operation, Richland, Wash.

THERMAL ANNEALING KINETICS OF INTERLAYER SPACING DAMAGE IN IRRADIATED GRAPHITE. R. E. Nightingale. June 21, 1955. Decl. Jan. 24, 1957. 46p. Contract W-31-109-Eng-52. $0.40(OTS).

A method has been developed to determine isothermal rates of annealing of radiation damage to the interlayer distance in graphite. Irradiated graphite samples were mounted in an insulating holder in a Norelco 180° x-ray diffractometer. An optical furnace and temperature control system were constructed to heat the sample to a constant temperature. Data were taken in a nitrogen atmos-

phere. Results are presented for graphite exposed in a cooled test hole facility in a Hanford reactor. Annealing was carried out at several constant temperatures in the range 100 to 750°C. For a sample with an exposure of 556 Mwd/ct, the C lattice parameter was decreased from 6,969 to 6,787 A. (J.E.D.)

3728 NBS-1D-101
National Bureau of Standards, Washington, D. C.
THE ENERGY CONTENT OF IRRADIATED GRAPHITE SAMPLES. Edward J. Prosen and William A. Fraser. May 31, 1951. Decl. Jan. 17, 1957. 9p. Project No. 3203. $1.80(ph OTS); $1.80(mf OTS).

Measurements of the energy contents of six samples of irradiated graphite were made by the heat-of-combustion method. The energy contents are compared with the energy content of a standard sample of unirradiated graphite previously measured. This report is a continuation of the study of the effect of pile irradiation and subsequent annealing on the energy content of graphite. (auth)

3729 NBS-D-103
National Bureau of Standards, Washington, D. C.
THE ENERGY CONTENT OF IRRADIATED GRAPHITE SAMPLES. Edward J. Prosen and Dorothy R. Valent. July 19, 1951. Decl. Jan. 17, 1957. 7p. Project No. 3203. $1.80(ph OTS); $1.80(mf OTS).

Measurements of the energy contents of seven samples of irradiated graphite were made by the heat-of-combustion method. The energy contents are compared with the energy content of a standard sample of unirradiated graphite previously measured. This report is a continuation of the study of the effect of pile irradiation and subsequent annealing on the energy content of graphite. (auth)

3730 NBS-D-104
National Bureau of Standards, Washington, D. C.
THE ENERGY CONTENT OF IRRADIATED GRAPHITE SAMPLES. Edward J. Prosen and Dorothy R. Valent. Oct. 5, 1951. Decl. Jan. 18, 1957. 6p. NBS Project 3203. $1.80(ph OTS); $1.80(mf OTS).

3731 NBS-D-107
National Bureau of Standards, Washington, D. C.
THE ENERGY CONTENT OF IRRADIATED GRAPHITE SAMPLES. [PART] V. Dorothy R. Valent and Edward J. Prosen. Dec. 3, 1951. Decl. Jan. 17, 1957. 7p. Project No. 3203. $1.80(ph OTS); $1.80(mf OTS).

Measurements of the energy contents of six samples of irradiated graphite were made by the heat-of-combustion method. The energy contents are compared with the energy content of a standard sample of unirradiated graphite previously measured. This report is a continuation of the study of the effect of pile irradiation and subsequent annealing on the energy content of graphite. (auth)

3732 NBS-D-109
National Bureau of Standards, Washington, D. C.
THE ENERGY CONTENT OF IRRADIATED GRAPHITE SAMPLES. [PART] VI. Dorothy R. Valent and Edward J. Prosen. Jan. 25, 1952. Decl. Jan. 17, 1957. 8p. Project No. 3203. $1.80(ph OTS); $1.80(mf OTS).

Measurements of the energy contents of five samples of irradiated graphite were made by the heat-of-combustion method. The result of a second measurement of a sample previously reported is also included here. The energy contents are compared with the energy content of a standard sample of unirradiated graphite previously measured. This report is a continuation of the study of the effect of pile irradiation and subsequent annealing on the energy content of graphite. (auth)

3733 NBS-D-111
National Bureau of Standards, Washington, D. C.
HEATS OF COMBUSTION OF IRRADIATED GRAPHITE AND DIAMOND SAMPLES. William A. Fraser and Edward J. Prosen. Feb. 8, 1952. Decl. Jan. 18, 1957. 17p. NBS Project 3203. $3.30(ph OTS); $2.40(mf OTS).

The total stored energies in irradiated samples of graphite and diamond were measured. The stored energy was determined as the difference in heats of combustion of irradiated and unirradiated samples using an oxygen bomb calorimeter. The heat of combustion of the reference sample of graphite was redetermined and measurements of stored energy were made on one sample of irradiated diamond and on six samples of irradiated graphite. (auth)

3734
VAPORIZATION COEFFICIENT OF GRAPHITE AND COMPOSITION OF THE EQUILIBRIUM VAPOR. R. J. Thorn and G. H. Winslow (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 26, 186-96(1957) Jan.

Direct comparisons of the rates of evaporation and of effusion from a Knudsen cell yield a value of about 0.15 for the vaporization coefficient of graphite. The absolute effusion rates, taken together with other data, not only confirm the existence of triatomic carbon in the equilibrium vapor but permit the evaluation of the thermodynamic properties of the triatomic vapor. In the region of 2400°K the vapor pressure of the triatomic form is $\log p_3(\text{atmos}) = -40296.0/T + 9.811$ which yields 184.4 kcal/mole for the heat of sublimation and 77.41 eu for the entropy of C_3. The vapor pressure equations used to determine the amount of monatomic and diatomic carbon in the equilibrium vapor are discussed. (auth)

Refer also to abstract 4162.

LABORATORIES AND EQUIPMENT

3735 CF-53-2-71
Oak Ridge National Lab., Tenn.
COMMENTS ON REMOTE VS DIRECT MAINTENANCE OF RADIOCHEMICAL PLANTS. F. L. Culler. Feb. 6, 1953. Decl. Oct. 31, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A qualitative comparison of the features and the advantages and disadvantages of remote and direct maintenance plans in radiochemical plants was made. (F.S.)

3736 HW-46013
[Hanford Atomic Products Operation, Richland, Wash.]
A DRIPLESS TRANSFER PIPETTE FOR RADIOCHEMICAL OPERATIONS. [Report of Invention]. Archie S. Wilson. Oct. 26, 1956. 2p. $1.80(ph OTS); $1.80(mf OTS).

3737
DESIGN PHILOSOPHY FOR A DIRECT-MAINTENANCE RADIOACTIVE CHEMICAL PLANT. D. G. Reid and K. K. Kennedy. Chem. Eng. Progr. 52, Symposium Ser. No. 19, 195-202.

During the 3 years of operation of the direct-maintenance Idaho Chemical Processing Plant for recovery of unspent nuclear fuel from irradiated fuel elements, certain basic requirements desirable in future installations have been developed. Presented are some of the general considerations to be taken into account, including use of commercially available equipment and recommended methods of performing some of the unit operations. (auth)

3738
A LABORATORY FOR STUDYING THE CHEMICAL EFFECTS OF GAMMA RAYS. J. F. Black, J. F. Kung, Jr., and G. B. Clark (Esso Research and Engineering Co., Linden, N. J.). Intern. J. Appl. Radiation Isotopes 1, 256-69(1957) Jan.

MOLECULAR STRUCTURE

3739 AEC-tr-2815

BASIC LEAD SULFATES. G. L. Clark, J. N. Mrgudich, and N. C. Schieltz. Translated by K. S. Bevis from Z. anorg. u. allgem. Chem. 229, 401-9(1936). 8p.

About 200 preparations of $PbSO_4$ were made and the x-ray patterns analyzed showing 3 fundamental line systems. These 3 line systems may be regarded as belonging to $4PbO \cdot PbSO_4$, $3PbO \cdot PbSO_4$, and $2PbSO_4$. The formulas for the latter two are certain, but proof of existence of $3PbO \cdot PbSO_4$ is not definite. (auth)

3740

ELECTRON IMPACT STUDIES ON C_2H_5Cl, C_2H_5Br, AND C_2H_5I. A. P. Irsa (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 26, 18-22(1957) Jan.

The appearance potentials and process of formation of the $C_2H_5X^+$, $C_2H_5^+$, CH_2X^+, and HI^+ ions have been studied. From the appearance potential data evidence is obtained for processes of production of these ions. These processes and their corresponding appearance potentials permit certain ionization potentials and bond energies to be derived. The ionization potentials obtained for the ethyl halides are $I(C_2H_5Cl) \leq 11.2 \pm 0.2$ ev, $I(C_2H_5Br) \leq 10.7 \pm 0.1$ ev, and $I(C_2H_5I) \leq 9.6 \pm 0.2$ ev. The carbon-halogen bond energies of these ethyl halides are $(C-Cl) \leq 3.6 \pm 0.3$ ev, $(C-Br) \leq 2.8 \pm 0.2$ ev, and $(C-I) \leq 2.4 \pm 0.4$ ev. Values of the carbon-carbon bond energy of C_2H_5Br and the ionization potential of CH_2Br are estimated to be 3.6 ev and 9.1 ev, respectively. The ionization efficiency curves of the negative halogen atoms from the ethyl halides are presented and some of their features discussed. (auth)

3741

VALENCE IN THE BORON HYDRIDES. William N. Lipscomb (Univ. of Minnesota, Minneapolis). J. Phys. Chem. 61, 23-7(1957) Jan.

The nature of the bonding and charge distribution in the known boron hydrides is discussed from the point of view of a simplified localized three-center orbital, and briefly from the more general molecular orbital point of view. (auth)

3742

ELECTRON DEFICIENT COMPOUNDS. R. E. Rundle (Iowa State Coll., Ames). J. Phys. Chem. 61, 45-50(1957) Jan.

There are a number of compounds for which the number of chemical bonds exceeds the number of valence electron, pairs, presenting a serious problem for classical valence theory. When atoms, inevitably metallic, with fewer valence electrons than low energy bonding orbitals, form compounds with atoms or groups containing no unshared electron pairs, bonding is delocalized to make use of all of the low energy metallic orbitals. This arises from the same quantum mechanical principles that lead to chemical bonding, and has perhaps been best treated for the H_3^+ ion, which serves as a prototype for electron deficient compounds. The geometry of methyl bridges is singled out for special discussion. Delocalization of bonding arising from "excess" orbitals, always from metal atoms, provides an interesting correlation running from organic compounds, through organometallic compounds and interstitial compounds, to metals themselves, delocalization increasing with fraction of "excess" orbitals. Certain special features of the generalization giving rise to weak metal-metal bonds in dsp^2-square transition metal complexes will be noted. (auth)

RADIATION CHEMISTRY

3743

ON THE USE OF IODINE AS A RADICAL DETECTOR IN HYDROCARBON RADIOLYSIS. Richard W. Fessenden and Robert H. Schuler (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 79, 273-6(1957) Jan. 20.

The effects of radiation on solutions of I_2 in cyclohexane have been studied over the I_2 concentration range of 5×10^{-4} to 5×10^{-2} M. The yield for the formation of alkyl iodide in deaerated solution is independent of iodine concentration from 10^{-5} to 5×10^{-3} M but is somewhat higher at higher concentrations. In the lower concentration region the radiation yield, G(RI), is found for both Co^{60} γ radiation and 2 Mev Van de Graaff electrons to be 5.6 molecules of alkyl iodide produced per 100 e.v. absorbed by the system. Aerated solutions of iodine in cyclohexane have lower yields than the corresponding deaerated solutions. For aerated solutions G(RI) is proportional to the iodine concentration at low concentrations and the kinetics indicate a simple competition between iodine and dissolved oxygen. The yield of uptake of radio-iodine to form stable alkyl iodides has been found to be equal to the yield of iodine disappearance, showing that the production of hydrogen iodide and hydrolyzable iodides is negligible. (auth)

RADIATION EFFECTS

3744

HOW RADIATION AFFECTS ORGANICS IN SOLVENT EXTRACTION OF FUEL. J. H. Goode (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 2, 68-71(1957) Feb.

In TBP-naphtha extraction systems for recovering U, Pu, and Th from irradiated fuels, solvent radiation damage is noticeable at 0.5 watt-hr/liter. However, the process is not seriously affected below 20 watt-hr/liter. (auth)

3745

RESISTANCE OF TERPHENYLS TO HEAT AND RADIATION. Eugene L. Colichman and Raymond F. Fish (North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 15, No. 2, 72-4(1957) Feb.

Ortho-, meta-, and para-terphenyl were submitted to temperatures (400 to 450°C) and radiation doses (up to 90-watt-hr/gm) approaching reactor-operation conditions. Results indicate sufficient stability for use as reactor moderator and coolant. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

3746

SYMMETRIES OF ELECTRIC FIELDS ABOUT IONS IN SOLUTIONS. ABSORPTION AND FLUORESENCE SPECTRA OF EUROPIC CHLORIDE IN WATER, METHANOL, AND ETHANOL. Edward V. Sayre, Donald G. Miller, and Simon Freed (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 26, 109-13(1957) Jan.

Salts of Eu which are regarded as strong electrolytes exhibit sufficiently sharp absorption spectra in solutions at room temperature while their fluorescence spectra became adequately discrete at the temperature of dry ice. The absorption spectrum of $EuCl_3$ in water proved to be the same as in a mixture of water and alcohol. The latter solutions furnished the fluorescence spectra at the temperature of dry ice. Fluorescence spectra of the alcoholic solutions in the form of glasses were obtained at 77°K and 4°K. The symmetry of the microfields about the europium ions in the anhydrous alcohols was C_{2v} while that about the ions in aqueous solutions was D_{2h}. (auth)

Refer also to abstract 3708.

SEPARATION PROCEDURES

3747 AERE-C/R-1661

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SEPARATION OF ZIRCONIUM AND HAFNIUM

FROM CALCIUM NITRATE, AQUEOUS NITRIC ACID SOLUTIONS WITH SELECTED TBP SOLVENT SYSTEMS. F. Hudswell, E. Furby, B. R. Harder, J. C. H. Waldron, and R. B. Andrews. May 12, 1955. 5p.

Partition coefficients for Zr, Hf, Ca and total NO_3^- have been determined directly for the aqueous system 1.5M $ZrO(NO_3)_2$/2.5M $Ca(NO_3)_2$ and 0.5M HNO_3 after equilibration with the solvents TBP, 50% TBP in xylene and 50% TBP in CCl_4. The results show that extraction would be too low to allow of economic operation in any of the conditions studied. Densities of the original and equilibrated solutions have also been recorded. (auth)

3748 AERE-CE/M-76

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SEPARATION OF TRIBUTYL PHOSPHATE FROM KEROSENE USING FERRIC CHLORIDE. S. S. Grimley and J. Kennedy. Dec. 14, 1953. 4p.

Preliminary experiments demonstrate that tributyl phosphate (TBP) in kerosene can be separated by formation of an immiscible $FeCl_3$ complex as a third phase when TBP–kerosene solutions are equilibrated with a saturated aqueous $FeCl_3$ solution. The TBP can be recovered in 99% yield by washing the separated immiscible phase with warm water. (auth)

3749 AERE-CE/M-94

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SEPARATION OF FELDSPARS FROM A METEORITE. (ORE NO. 50). S. W. F. Patching. Feb. 3, 1953. 7p.

A piece of meteorite was treated by crushing, sizing, and high intensity magnetic separation to obtain a concentrate of the feldspars present as one of the major constituents. It was desired for study purposes to obtain a feldspar product as clean as possible, recovery being unimportant. The products obtained appeared by visual observation to contain approximately 95% feldspars. (auth)

3750 CF-54-2-101

[Oak Ridge National Lab., Tenn.]

THOREX PROCESS: DEMONSTRATION OF FEASIBILITY OF USE OF STEAM JETS IN INTERNAL DECONTAMINATION OF VESSELS. W. T. McDuffee. Feb. 11, 1954. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 8p. Contract W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

3751 CF-54-8-77

Oak Ridge National Lab., Tenn.

THOREX: GENERAL OUTLINE PRE-HOT RUN MANUAL. G. W. T. Kearsley and H. H. Messenheimer. Aug. 5, 1954. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

3752 CF-55-4-193

Oak Ridge National Lab., Tenn.

FLOTATION OF FISSION PRODUCT PARTICLES IN THE UNDERFLOW RETENTION TANK. H. O. Weeren. Apr. 27, 1955. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

3753 CF-55-6-93

Oak Ridge National Lab., Tenn.

OPERATION OF COOLING SYSTEM FOR UNDERFLOW RETENTION TANK. H. O. Weeren. June 10, 1955. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

3754 CF-55-9-10

Oak Ridge National Lab., Tenn.

ORE PROCESSING: RESIN TEST LOOP STUDY–MECHANICAL ATTRITION TESTS; TERMINATION REPORT. J. C. Bresee and C. W. Hancher. Sept. 2, 1955. Changed from OFFICIAL USE ONLY Dec. 20, 1956. 15p. Contract [W-7405-eng-26].

An attrition loop has been constructed to study the mechanical attrition of resin during the operation of a Higgins continuous ion exchange column. The loop was operated for 350 hr with resin in water and 900 hr with resin in mill pulp. Applying the results of these tests to the prediction of the mechanical attrition rate in the 6-in. Higgins column, a probable value of 13%/yr was obtained. The maximum value which could be expected from extrapolation of the data to 6-in. column operation was 45%/yr. From these data it can be shown that attrition of resin the 6-in. Higgins column due to mechanical action probably would contribute very little to the chemical cost of operating such a column. (auth)

3755 DOW-112-A

Dow Chemical Co. Western Div., Pittsburg, Calif.

COMMERCIAL UTILIZATION OF FLORIDA LEACHED ZONE ORE. D. A. Ellis and H. W. Hill. Feb. 24, 1954. Changed from OFFICIAL USE ONLY Sept. 29, 1955. 34p. Contract AT-30-1-GEN-236. $6.30(ph OTS); $3.00(mf OTS).

Four processes which appear to be economically feasible for the conversion of leached zone ore (a phosphatic ore located in Florida) to marketable products are discussed. A caustic leach process for preparing alumina and sodium phosphates is considered in more detail in an appendix. (auth)

3756 NAA-SR-1710

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PYROMETALLURGICAL PROCESSES FOR THORIUM–URANIUM FUEL. Semiannual Progress Report [for] January–June 1956. A. G. Buyers and E. E. Motta. Feb. 1, 1957. 34p. Contract AT-11-1-GEN-8. $0.30(OTS).

Experimental work on the de Boer iodide process with irradiated Th is reported. Other studies are reported in the volatilization of U and fission products from molten and solid Th–U alloy, volatilization of fission products from arc-melted Th–U alloy, fused salt–molten Th–U alloy equilibration, and electrorefining of Th from molten halide baths. (For preceding period see NAA-SR-1724.) (T.R.H.)

3757 NAA-SR-1796

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRE QUARTERLY PROGRESS REPORT [FOR] JULY–SEPTEMBER 1956. E. E. Motta, D. I. Sinizer, J. R. Foltz, and K. L. Mattern. Feb. 1, 1957. 21p. Contract AT-11-1-GEN-8. $0.25(OTS).

An outline of the projected PRE (Pyroprocessing Refabrication Experiment) program is given. Progress in the initial design, procurement, and development phase is reported. (T.R.H.)

3758 NP-6190

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

SOLVENT EXTRACTION STUDIES ON URANIUM BEARING SOLUTIONS. Progress Report No. 3 [for] June–August 1956. A. Bellingham and R. Simard. Nov. 20, 1956. 13p. (SR-454/56).

Batch and continuous tests were made on the use of a magnesia slurry for stripping loaded amine solvent. While the chemical aspects are quite satisfactory, the physical disengagement of the precipitate from the organic phase is difficult and significant quantities of organic solvent remain in the aqueous slurry. A rotating-disc column

extractor has been investigated for the amine solvent/leach liquor system. A maximum specific flow of 57 gallons/hr/sq ft was obtained and efficiencies are within the range of 0.5 to 1.5 stages per foot of column height. Previous solvent extraction work has shown that the use of the amine type of extractant in kerosene offers the most advantages from a practical point of view in the extraction of uranium from sulfate leach liquors. (auth)

3759 ORNL-2002

Oak Ridge National Lab., Tenn.

NARRATIVE STATUS REPORT OF RAW MATERIALS CHEMISTRY SECTION. Nov. 11, 1955. 40p. Contract W-7405-eng-26. $0.30(OTS).

3760 RMO-4005(Pts. A and B)

Columbia Univ., New York. Mineral Beneficiation Lab.

RECOVERY OF URANIUM FROM CHATTANOOGA SHALE. PART A. CHLORINATION STUDIES. PART B. LEACHING STUDIES. Status Report for September 1955. Changed from OFFICIAL USE ONLY Jan. 28, 1957. 116p. (Pt. A). $18.30(ph OTS); $6.00(mf OTS) and 195p. (Pt. B). $30.30 (ph OTS); $8.70(mf OTS). Contract AT(49-1)-621.

These two parts were issued separately, but are cataloged as a unit.

A study was made of the separation of U from chloride products produced by chlorination of retorted Chattanooga shale in a fluidized bed and of the limitation in U recovery from the shale by leaching. (J.E.D.)

3761 WIN-57

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH–FILTRATION PILOT PLANT TESTING OF TODILTO BLACK LIMESTONE ORE. A. W. Griffith, W. A. Millsap, and G. Winslow. Dec. 19, 1956. 37p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

Test results show Todilto Black Limestone ore to be amenable to the Alkaline Leach–Filtration process. The assays of the ore for the run averaged 0.188% U_3O_8, 81.0% $CaCO_3$, and 0.15% V_2O_5. The average grind obtained on the ore for the entire run was 5.8% plus 65 mesh and 66.8% minus 200 mesh. A uranium extraction of 94.1% (residue assay–0.011% U_3O_8) was obtained on this ore when leaching in an alkaline solution containing 59.2 g Na_2CO_3 and 11.6 g $NaHCO_3$ per liter for 48 hr in Pachuca tanks at a pulp temperature of 180°F and atmospheric pressure with air added for oxidation. An average filtration rate of 1315 lb/sq ft/24 hr was obtained on the vacuum drum filters. Higher filtration rates were obtained when using 0.05 lb Separan 2610/ton of ore as a filtering aid. The average soluble loss for the entire run amounted to 1.5% of the U contained in the mill feed. Precipitation of the yellow cake from pregnant liquors was accomplished by using an average excess of 7.5 g NaOH/l. The final yellow cake product averaged 75.29% U_3O_8. An equivalent of 28.6 lb NaOH and 0.56 gal of No. 1 fuel per ton of ore were used in the processing of this ore. Over-all calculated U recovery based on known losses was 91.1%. Recovery based on yellow cake assays and weights was 91.7%. A metallurgical balance for the run resulted in an unaccountable gain of 0.6%. (auth)

3762 AEC-tr-2810

INVESTIGATION OF RECTIFICATION IN SPINNING ROTOR COLUMNS. V. A. Malyusov (Malusov), N. N. Umnik, and N. M. Zhavoronkov. Translated from Doklady Akad. Nauk S.S.S.R. 106, 99-102(1956). 3p. Available from Consultants Bureau, Inc., New York.

The use of a spinning rotor in wetted wall distillation columns is discussed. (T.R.H.)

3763

ACETYLACETONE AS ANALYTICAL EXTRACTION REAGENT. INCREASE IN SELECTIVITY WITH (ETHYLENEDINITRILO) TETRAACETIC ACID AND ANALYTICAL SEPARATION OF URANIUM FROM BISMUTH. Anoop Krishen and Henry Freiser (Univ. of Pittsburgh, Penna.). Anal. Chem. 29, 288-90(1957) Feb.

Extraction behavior of uranyl, copper(II), lead(II), and bismuth(III) acetylacetonates was studied. The selectivity of separations was enhanced when (ethylenedinitrilo)tetraacetic acid was used as the competing complexing agent. Extraction with acetylacetone in the presence of EDTA, followed by polarographic estimation, was successfully utilized to develop a method for separation of U in the presence of as much as a 5000-fold excess of Bi. (auth)

3764

THE SOLVENT EXTRACTION BEHAVIOR OF INORGANIC COMPOUNDS. II. GENERAL EQUATIONS. R. M. Diamond (Cornell Univ., Ithaca, N. Y.). J. Phys. Chem. 61, 69-74 (1957) Jan.

A general expression is obtained for the distribution quotient, D, of a metal halide between an aqueous hydrohalic acid phase and an organic solvent. Cationic, neutral, anionic, and polymeric (associated) metal halide species are considered. The variations in this quotient with changes in concentration of the halide ion, of the hydrogen ion, of other halide salt, and of other strong acid, as well as of total metal halide, are also given. With increasing concentration of one of these substances, the value of D varies in such a way as to favor that phase in which the average metal-containing species contains more of that substance, i.e., more metal, halide or hydrogen ion. But even when the same metal halide species exists in both phases, D may still vary through a "common ion" effect. For example, D may vary with total metal concentration even when only the same ionic metal-containing species exists in both phases, if another substance with a common ion is present, and the common ion from it dominates one, but only one, phase. (auth)

3765

THE SOLVENT EXTRACTION BEHAVIOR OF INORGANIC COMPOUNDS. III. VARIATION OF THE DISTRIBUTION QUOTIENT WITH METAL ION CONCENTRATION. R. M. Diamond (Cornell Univ., Ithaca, N. Y.). J. Phys. Chem. 61, 75-81(1957) Jan.

The metal ion concentration dependence of the quotient expression previously derived has been tested for Mo^{6+} at concentrations from 10^{-6} to 10^{-2} M distributing between aqueous HCl, HBr and mixed HCl–HNO_3 and HBr–$HClO_4$ acids and the following oxygenated organic solvents: diethyl, β,β'-dichlorodiethyl and dibutyl ethers, methyl isobutyl and methyl amyl ketones and 2-ethylhexanol. These results are interpreted in terms of the expression derived for $\partial \log D/\partial \log Q$ and show that both polymerization of the metal-containing species and the "common ion" effect can cause a variation of D with Mo^{6+} concentration. Some information on the Mo^{6+} species is also obtained. It is shown that polymeric forms can exist in the aqueous solutions at hydrohalic acid concentrations below 6 M (and < 10^{-1} M Mo), but no appreciable amount of monomeric cations is present; the main species are apparently the anions of acids stronger than HCl. (auth)

SORPTION PHENOMENA

3766 AECU-3400

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

HYDROLYTIC AND ION PAIR ADSORPTION PROCESSES

IN FLOTATION, ION EXCHANGE AND CORROSION. Technical Report No. XXVI. Melvin A. Cook and Milton E. Wadsworth. Nov. 1, 1956. 27p. Project No. 1. Contract AT(11-1)-82. $4.80(ph OTS); $2.70(mf OTS).

General free acid and free base adsorption processes are treated. The generalizations are then applied to flotation, corrosion of metals and metal oxides, ion exchange, and textile dyeing. (T.R.H.)

3767 AERE-C/R-1547

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MOTION OF IONS NEAR THE SURFACE OF A POLARIZED ANION EXCHANGE MEMBRANE. G. C. Barker. Nov. 23, 1954. 12p.

Approximate expressions are derived for the limiting current density at a polarized anion exchange membrane in the case of forced convection in the solution near the membrane surface. (auth)

SYNTHESES

3768 NOL-CORONA-140

Naval Ordnance Lab., Corona, Calif.

HIGH TEMPERATURE DIELECTRIC MATERIALS. Interim Report No. 4 [for] January–March 1954. C. P. Haber. Apr. 1954. 12p.

Diphenylvinylsilane has been prepared, characterized, and polymerized. Preliminary results show that polymerization has taken place by the desired reaction mechanism, namely, the addition of the elements of the silicon–hydrogen bond across the vinyl unsaturation. The preparation of the perfluoromethyliodophosphines has been accomplished by the reaction of perfluoromethyl iodide with white phosphorous in a closed system at elevated temperatures. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

3769 AERE-C/M-23

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

DETECTION OF PLUTONIUM BY IRRADIATION IN THE PILE. H. A. C. McKay. [1949?]. 4p.

A procedure for the determination of Pu^{239} by irradiation in a high neutron flux rather than by direct α counting is discussed. (W.L.H.)

3770 AERE-C/R-865

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SOLUBILITY OF PuF_4 IN NITRIC ACID SOLUTIONS AND THE SOLUBILITY PRODUCT OF PuF_4. C. J. Mandleberg and K. E. Francis. Feb. 20, 1952. Decl. Nov. 26, 1956. 4p.

The solubility of PuF_4 has been determined in nine HNO_3 solutions from 0 to 3.19M, and the solubility product of PuF_4 calculated. (auth)

3771 AERE-C/R-1207

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE THERMOGRAVIMETRY OF SOME PLUTONIUM COMPOUNDS. J. K. Dawson and R. M. Elliott. June 8, 1953. Decl. Nov. 26, 1956. 20p.

The effects of heat on PuF_3, PuF_4, $Pu(SO_4)_2$, $Pu(IO_3)_4$, $Pu(C_2O_4)_2$ and $Pu_2(C_2O_4)_3$ were studied by means of a silica spring thermobalance. (T.R.H.)

3772 ANL-JJK-14B-45

[California. Univ., Berkeley. Radiation Lab.].

ANALYSIS FOR Pu(III) AND Pu(IV) ON A TRACER SCALE. E. L. King. [1944]. Decl. Mar. 16, 1956. 46p. Contract No. W-7405-Eng-48B. $7.80(ph OTS); $3.00(mf OTS).

This report is based on CN-2726 (Dec. 1, 1944).

Several different procedures for the tracer scale analysis of solutions of Pu were investigated. The purpose of these procedures has been the determination of the fraction of the Pu present in the +3 oxidation state in solutions containing mainly Pu(III) and Pu(IV). Procedures involving the use of Nb oxide and La ammonium oxalate were not feasible. Preliminary experiments indicated that Pu(IV) is carried by ThP_2O_7 while Pu(III) is not carried. Further investigation might prove the use of a procedure involving ThP_2O_7 to be highly feasible. The use of Zr phenylarsonate to carry Pu(IV) and at the same time leave Pu(III) in the supernatant solution has been investigated quite thoroughly. Difficulties were encountered in the prevention of the reduction of Pu(IV) to Pu(III) during the course of the analysis. It was found that Cl_2 present at a concentration of 2×10^{-4} N prevented the reduction of Pu(IV) and at the same time did not oxidize Pu(III). Successful analyses of solutions containing Pu(III) and Pu(IV) were carried out using Cl_2 as an oxidant. In connection with the work on the Zr phenylarsonate procedure, the formulas of Pu(IV) phenylarsonate and Zr(IV) phenylarsonate were found to be $Pu(C_6H_5AsO_3)_2 \cdot xH_2O$ and $Zr(C_6H_5AsO_3)_2 \cdot yH_2O$ respectively. A procedure is proposed involving the use of zirconium phenylarsonate and LaF_3 to determine the amount of Pu(III), Pu(IV), and Pu(VI) in solutions containing all three oxidation states. Although the analysis did not prove successful, the discrepancy may have been due to a trace of Fe(III) in the Pu solution. It is proposed that the Fe(III) may have catalyzed the oxidation of Pu(III) to Pu(IV) by Cl_2. (auth)

3773

A REVIEW OF THE PHYSICAL METALLURGY OF PLUTONIUM. A. S. Coffinberry (Los Alamos Scientific Lab. N. Mex.) and M. B. Waldron (Atomic Energy Research Establishment, Harwell). Progr. of Nuclear Energy 1, Series V, 354-410(1956).

The historical development of plutonium metallurgy, in so far as it is known to the authors, has been traced up to the point at which detailed publication of results became possible through declassification changes. The precautions found to be necessary for the safe handling of plutonium are summarized and the means of giving effect to these in different laboratories are discussed. The available data on the physical properties and intermetallic compounds of plutonium are reviewed, with the inclusion of some recent unpublished information. An attempt has been made to cover effectively the work on plutonium metallurgy in America, Britain and Canada, but knowledge of Russian achievements is limited to that disclosed in a single article by Konobeevsky. There are, of necessity, some fields of work by American and British laboratories which remain unpublishable and represent a gap in the scope of this paper. (auth)

Refer also to abstracts 3696 and 3814.

TRITIUM AND TRITIUM COMPOUNDS

Refer to abstract 3668.

URANIUM AND URANIUM COMPOUNDS

3774 IGR-R/CA-193

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.

FORMATION AND DISPROPORTIONATION OF INTERMEDIATE URANIUM FLUORIDES (WITH AN APPENDIX ON RATES OF FLUORINATION). V. Y. Labaton. Oct 3, 1956. 24p.

3775
ABSORPTION SPECTRA OF RED URANIUM(III) CHLORO COMPLEXES IN STRONG HYDROCHLORIC ACID. Chr. Klixbull Jorgensen (Univ. of Denmark, Copenhagen). Acta Chem. Scand. 10, No. 9, 1503-5(1956).

3776
DETERMINATION OF URANIUM IN THE ACCESSORY MINERALS. I. E. Starikh, L. Ya. Atrashenok, and A. Ya Krylov (Khlopin Radium Inst.). Doklady Akad. Nauk S.S.R. 111, 644-6(1956) Nov. 21. (In Russian)

A method of direct fusion of U with a bead of NaF reveals the quantities of U even in the tiniest crystals of accessory minerals, without any preliminary chemical treatment. Tables showing the estimations of minimum quantities of U ($n \times 10^{-3}$ %) in mixture with other minerals. (R.V.J.)

3777
THE SOLUBILITY OF SEVERAL METAL SULFATES AT HIGH TEMPERATURE AND PRESSURE IN WATER AND IN AQUEOUS URANYL SULFATE SOLUTION. Ernest V. Jones, M. H. Lietzke, and William L. Marshall (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 267-71(1957) Jan. 20.

The solubility of several metal sulfates at high temperature and pressure has been determined in H_2O and in aqueous UO_2SO_4. In most of the systems investigated a large increase in solubility of the metal sulfate is observed at a given temperature as a function of increasing UO_2SO_4 concentration. This type of behavior points to a considerable degree of complexing in the saturated solutions. Several heats of solution have been determined and a possible relationship between these values and the amount of complexing is suggested. (auth)

Refer also to abstract 4165.

WASTE DISPOSAL

3778 CF-54-5-89
Oak Ridge National Lab., Tenn.
PRECONCENTRATION OF HIGH ACTIVITY ACID WASTE FOR THE OAK RIDGE CHEMICAL PROCESSING PLANT. J. L. Dodson. May 17, 1954. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A preliminary process and cost analysis for the preconcentration of the high activity waste from the Oak Ridge Chemical Processing Plant has been prepared. These data show that it is considerably cheaper to continuously evaporate the raffinate as it comes from the (1A) extraction column rather than evaporate batch wise in waste hold tanks. In addition continuous evaporation appears to be a much more attractive process. On basis of these data it is recommended that continuous evaporation be used if preconcentration is required. (auth)

3779 ORNL-932
Oak Ridge National Lab., Tenn.
STUDIES ON THE REMOVAL OF RADIOISOTOPES FROM LIQUID WASTES BY COAGULATION. Robert A. Lauderdale, Jr. Jan. 23, 1951. Changed from OFFICIAL USE ONLY Oct. 23, 1956. 30p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Work completed to date on the removal of radioisotopes from water using a calcium phosphate floc as a carrier is reported. It has been found possible to remove from solution essentially all the Ce, Y, Zn, Nb, and Zr by phosphate precipitation. Approximately 10% of the W, 67% of the Sb, and 95% of the Sr were removed by the phosphate treatment. Efficiencies of removal greater than 99% have been obtained with a mixture of fission products by using clay in conjunction with the phosphate, followed by sand filtration. The efficiency of the process when used with a mixture of radioactive isotopes will depend on the composition of the mixture. The greatest concentrations of activity in the floc were obtained under conditions of high pH and with an excess of phosphate. (T.R.H.)

ENGINEERING

3780 BW-5421
Babcock and Wilcox Co. Research Center, Alliance, Ohio.
TEMPERATURE AND PRESSURE CYCLING OF A FULL DIAMETER TEST VESSEL. J. A. Speeds. June 11, 1953. 36p. For Westinghouse Electric Corp. [Atomic Power Div.] Subcontract 14-302.

A full diameter test vessel was used to carry out a series of temperature and pressure cycles. The vessel was first cycled from 500 to 200°F at a constant pressure of 2000 psi. Three cooling rates were used to determine varying temperature gradients, 3°F per hr, 50°F per hr, and 185°F per hr. These cooling rates were established at the closure weld location, thermocouple 9 and 10. Thirty cycles were run at the 185°F per hr cooling rate as an accelerated proof test of the vessel. The results from this accelerated test are extrapolated to show an equivalent test of 1400 cycles at a 50°F per hr cooling rate. A single cycle at 50°F per hr cooling rate was run to establish the actual temperature gradients and aid in the evaluation of the accelerated test. At the conclusion of the testing, the vessel was allowed to cool naturally in the atmosphere and a cooling rate of 3°F per hour resulted. The test vessel was further subjected to 100,000 cycles at room temperature from 900 to 2500 psi water pressure. Only minor surface defects were discovered. No propagation of a known defect in the weld occurred. The closure studs did not show any trend of relaxing due to the fatigue test. Results from these tests justify full confidence in the vessel design. (auth)

3681 HW-36887
[Hanford Atomic Products Operation, Richland, Wash.]
AIR LEAKAGE THROUGH LABYRINTH SEALS. P. B. McCarthy. Apr. 8, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A graphitar no. 2 labyrinth seal with a type 347 stainless steel shaft rotating at 1750 rpm inside was subjected to variable shaft diameters, pressure differences, diametral clearances, and seal lengths and was examined for air leakage. Under none of the conditions tested did the seal leakage exceed 1.5 cfm. (T.R.H.)

3782 HW-39820
[Hanford Atomic Products Operation, Richland, Wash.]
105-VALVE PIT 24-INCH HEADER SCREEN. C. W. Botsford. Nov. 4, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Recommended changes in the three 190-C valve pit 24-in. header screens are given. (T.R.H.)

3783 NP-6179
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 37 FOR OCTOBER AND NOVEMBER 1956. W. J. Posey, ed. Dec. 13, 1956. 60p. Contract NObs-65426.

The operation of the 1000-kw heat transfer unit at high temperatures was demonstrated to aid development of components for such service and to add to the body of liquid metal technology, 3000-kw steam generator tests

were made as part of a steam generator development. Research on liquid metal system components is reported. Thermal shock tests were made on a tee in the S2G system used to join two liquid metal streams of different temperatures. Experimentation in which results are evaluated by chemical or radiochemical techniques including experiments in the field of organics is reviewed. High velocity corrosion testing in biphenyl of reactor materials is reported. (For preceding period see NP-6132.) (J.E.D.)

3784 NYO-7179

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. July 31, 1956. 78p. Contract AT(30-1)-956. (MIT-S-32). $0.45(OTS).

Investigations are reported on the adsorption of flotation agents of AgI; electrochemical adsorption on Ag_2S; solubility of quartz; adsorption of inorganic ions on quartz; streaming potential studies on corundum; slime coatings on galena; use of a modified Hallimond tube for study of flotation of sphalerite; adsorption of hexyl mercaptan on Au; solvent extraction of cobalt thiocyanate complexes; effects of chemical agents in comminution; and fracture patterns of crushed glass. (For preceding report in series NYO-7178.) (J.E.D.)

3785 AEC-tr-2676

STATIC CALCULATION OF BOILER BOTTOMS. (Statische Berechuung von Kesselboden.) Maria Esslinger. Published by Julius Springer (Berlin, 1952). p.1-39. 48p.

A method of calculating force distribution in boilers of various sizes is discussed, and the equations for numerical solutions are given. The boilers considered are assumed to have cylindrical sides and hemispherical ends. (D.E.B.)

HEAT TRANSFER AND FLUID FLOW

3786 CF-57-1-88

Oak Ridge National Lab., Tenn.

SECONDARY REFRIGERANT FOR HRT REFRIGERATION SYSTEM. R. C. Robertson and H. A. McLain. Jan. 24, 1957. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The criteria for selection of an HRT secondary refrigeration system refrigerant to replace Freon-11 are given. The properties of Amsco which make it desirable are tabulated and it is compared with triethyl phosphate (the second choice) and Freon-11. (T.R.H)

3787 HW-30225

[Hanford Atomic Products Operation, Richland, Wash.]

HEAT FLOW PROBLEMS WITH TEMPERATURE DEPENDENT THERMAL CONDUCTIVITY. P. M. Anselone, D. O. Banks, and R. Y. Dean. Dec. 10, 1953. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

3788 HW-46717

Hanford Atomic Products Operation, Richland, Wash.

NOTE ON POWER RECOVERY FROM WARM WATER. E. C. Wood. Nov. 15, 1956. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A power recovery plant for Hanford pile effluents utilizing a water expansion cycle is envisioned. A wheel fitted with nozzles at the periphery directed tangentially away from the direction of rotation is fed with warm water near the center. (T.R.H.)

3789 KAPL-M-EJP-2

Knolls Atomic Power Lab., Schenectady, N. Y.

EXAMINATION OF THE FORCED CIRCULATION STEAM GENERATOR FROM THE LIQUID METAL HEAT TRANSFER TEST FACILITY AT ALPLAUS, NEW YORK. Report No. 2. E. J. Placzkowski. Apr. 11, 1954. Changed from OFFICIAL USE ONLY Oct. 8, 1956. 19p. Sub-Project No. 70: INVESTIGATION OF ALPLAUS UNITS. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The metallurgical investigation of the forced circulation steam generator revealed the failure of two Type 347 stainless steel tubes (air outside, mercury inside). The two tubes were located at the top of the unit and the failures occurred at the tube sheet welds (both "hot" and "cold" ends). The cracking was attributed to thermal cycling involving temperatures and stresses above the design values. (auth)

3790 KAPL-M-SMS-52

Knolls Atomic Power Lab., Schenectady, N. Y.

THE DIFFUSION OF AIR THROUGH THE BARRIER OF A COMMERCIAL ACCUMULATOR. F. C. Steiner. Jan. 15, 1957. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The tests performed with two 10 gal Greer hydraulics accumulators indicate that the diffusion of air through the bladder of the units is quite appreciable and results in excessive air concentrations in the accumulator water after relatively short periods. Commercial accumulators as a source of high pressure water for operation of hydraulically operated valves and for emergency pressurization of the primary coolant system are, therefore, not suitable since excessive amounts of air could be introduced into the primary coolant. (auth)

3791 KAPL-M-WLF-5

Knolls Atomic Power Lab., Schenectady, N. Y.

EXAMINATION OF THE NATURAL CIRCULATION STEAM GENERATOR FROM THE LIQUID METAL HEAT TRANSFER TEST FACILITY AT ALPLAUS, NEW YORK. Report No. 2. E. J. Callahan and W. L. Fleischmann. Sept. 12, 1953. Changed from OFFICIAL USE ONLY Oct. 8, 1956. 35p. Problem No. 70: INVESTIGATION OF THE CAUSES OF CRACKING IN THE NATURAL CIRCULATION. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

The first structural failure of a heat exchanger used in the Alplaus liquid metal system is discussed. The metallurgical examination revealed failure of two Type 347 stainless steel tubes (NaK outside, mercury inside) and two tube sheets. The location of the failure was confined to the hot end and the area around these two hottest tubes. Judging by the fracture appearance, the majority of the cracks were caused by thermal cycling. Further studies are under way to establish more definitely the cause of the failure. (auth)

3792 NP-6186

Massachusetts Inst. of Tech., Cambridge. Div. of Industrial Cooperation.

THE THERMODYNAMICS OF BUBBLES. Technical Report No. 7. John A. Clark. Jan. 1, 1956. 41p. D.I.C. Project No. 5-7348. Contract N5ori-07827.

This paper outlines those conditions demanded by the laws of thermodynamics for equilibrium between the vapor in a bubble and the surrounding liquid and then employs these concepts with a nucleation theory in an attempt to arrive at an expression relating the nucleating superheat in a pure liquid to other fluid properties. The first part of the paper deals with the phase equilibrium across a curved interface and some of its consequences. In the second part recourse is made to the kinetic theory of "Heterophase" thermal fluctuations given by Frenkel for nucleus formation which is extended and employed to derive a relationship between a superheat at nucleation and other fluid properties. (auth)

3793 NP-6188
Massachusetts Inst. of Tech., Cambridge. Div. of Industrial Cooperation.
BUBBLE GROWTH RATES IN BOILING. Technical Report No. 8. Peter Griffith. June 1956. 35p. D.I.C. Project Nos. 5-7348 and 5-7374. Contract N5ori-07827.

The conditions determining the growth rate of a bubble on a surface in boiling are considered and a mathematical model framed in the light of these conditions. The growth rate is then calculated for bubbles growing under a range of conditions of pressure, wall superheat and bulk fluid temperature. The average growth rate of a bubble is found to decrease with increasing maximum size and to decrease with increasing pressure. At high pressure the maximum size of the bubble is found to be independent of pressure and primarily a function of the thickness of the superheated layer near the surface. The calculated bubble growth velocities are then used to correlate some burnout data for a variety of fluids under a range of pressures in pool boiling. Bubble growth pictures are presented for water at atmospheric pressure under a variety of conditions. (auth)

3794 WAPD-TH-233
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
HEAT TRANSFER AND FLUID FLOW PROGRAM OF THE BETTIS THERMAL AND HYDRAULICS SECTION (A1W PROJECT). Period [covered] July 1–December 31, 1956. 20p. $3.30(ph OTS); $2.40(mf OTS).

3795 AEC-tr-2807
ON THE PHENOMENA OF TWO-DIMENSIONAL FLOW FROM APERTURES UNDER HEAD. (Sui Fenomeni di Efflusso Piano da Luci a Battente). E. Marchi. Translated from Ann. Mat. pura ed Appl. (4), 35, 327-41(1953). 16p.

Refer also to abstracts 3815 and 4107.

MATERIALS TESTING

3796 HW-37960
[Hanford Atomic Products Operation, Richland, Wash.
FUNCTIONAL TESTING OF TEFLON FLEXIBLE CONNECTOR, 105-C TYPE. Final Report—Production Test 105-585-A. J. P. Cooke. July 15, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The probable useful life limit of the Fluoroflex Teflon tube enclosed in a stainless-steel-braid sheath is about 10^8 r or about 3 yr in contact with fresh effluent. (T.R.H.)

3797 RL-8.6.5
California. Univ., Berkeley. Radiation Lab.
HEAT RADIATION AND EMISSIVITY MEASUREMENTS. J. G. Dorward and Donald Reed. May 6, 1944. Changed from OFFICIAL USE ONLY June 22, 1956. 22p. Contract [W-7405-eng-48]. (M-895; Eng. Spec.-5). $4.80(ph OTS); $2.70(mf OTS).

Stainless steel, copper, monel, nickel, silco, aquadag, and acetylene soot were tested for their heat radiation and emissivity characteristics. These characteristics are an indication of suitability for use in high vacuum systems. Silco was selected as having the best emissivity characteristics and the best method of applying it was sought. (T.R.H.)

3798
A RADIOACTIVE DEPOSIT GAGE FOR ENGINES. B. A. Fries, J. G. Mingle, and H. W. Sigworth (California Research Corp., Richmond). Intern. J. Appl. Radiation Isotopes 1, 270-5(1957) Jan.

Conventional methods of measuring engine deposits require many hours of operation and extensive disassembly of the engine. A rapid and sensitive deposit gage has been developed, based on a removable plug with a radioactive surface which forms part of the inside wall of the engine. A deposit accumulates on this surface while the engine runs. Its thickness is measured by removing the plug and comparing the attenuation of the radiation caused by the deposit with that caused by absorbers of known thickness. Sulfur-35 and cobalt-60 are the most suitable radioisotopes. With this technique, buildup of deposits can be observed in relatively inaccessible portions of the engine. Effects of operating variables and fuel composition can be explored quickly and accurately in combustion chambers, intake manifolds, and carburetors of automotive engines. The radioactive deposit gage can be applied to deposit measurements in inaccessible portions of any equipment. (auth)

3799
MEASUREMENT OF THIN FILM THICKNESSES BY β BACK-DIFFUSION. L. Danguy (Institut des Sciences Nucléaires, Mons). Intern. J. Appl. Radiation Isotopes 1, 276-83(1957) Jan. (In French)

PUMPS

3800 WAPD-EM-143-1
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
PUMP BEARING MATERIAL SCREENING PROGRAM. Eugene J. Cattabiani. Sept. 2, 1952. Changed from OFFICIAL USE ONLY Oct. 15, 1956. 27p. $4.80(ph OTS); $2.70(mf OTS).

3801 WAPD-EM-174
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh
TEST OF WAPD COOLANT PUMPS. J. D. Walls. Mar. 28, 1952. Changed from OFFICIAL USE ONLY Oct. 1, 1956. 70p. Contract AT-11-1-GEN-14. $10.80(ph OTS); $3.90(mf OTS).

Complete results are given of various tests made on WAPD coolant pumps. These tests include thrust, hot resistance, variable voltage, overspeed, stop-start, and coasting tests. Preliminary design specifications for the primary pumps are included in an appendix. (B.J.H.)

RADIOGRAPHY

Refer also to abstract 3929.

TRACER APPLICATIONS

3802
RADIOTRACER STUDIES OF FLOW PATTERNS IN INDUSTRIAL PLANTS. D. E. Hull (California Research Corp., Richmond). Intern. J. Appl. Radiation Isotopes 1, 305-13(1957) Jan.

The flow pattern of materials in large units of industrial-plant equipment may be studied with radiotracers. A portion of the material is tracered with a gamma-ray isotope so its movement inside the plant can be followed with a Geiger counter outside without disturbing operations. The uniformity of flow of solid particles in a moving bed was studied to guide the design of orifice plates. Catalyst beads in continuously circulating systems in catalytic cracking plants were tracered to detect deviations from the normal flow pattern in a catalyst bed and to forecast shutdowns necessitated by immobilized portions of the bed, to measure the relative loads carried by parallel pipes in the gas-lift part of the plant, and to appraise a system of baffle

plates designed to promote uniform flow in another conduit in the plant. The trays in a large distillation unit were suspected not to be uniformly covered; a tracer injection into the liquid disclosed that some channels on the trays were blocked. (auth)

WASTE DISPOSAL

3803 HW-37680
Hanford Atomic Products Operation, Richland, Wash.
STUDY OF WASTE FACILITIES. H. W. Stivers. June 30, 1955. Changed from OFFICIAL USE ONLY Nov. 26, 1956. 19p. Contract [W-31-109-Eng-52].

The vault and the cavern type of storage facilities could be economically supplemented with the present tanks or used separately to meet the demands of present and future intermediate level radioactive wastes. The bare tank costs of these facilities for intermediate level waste storage are, respectively, $0.08 and $0.065 per gallon less than present conservative circular tanks used for intermediate and high level waste storage. This represents a 60 to 50% cost saving potential. The design criteria and the general shape of the facilities reduce the construction materials and earth-work quantities to achieve these lower unit costs. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

3804
TITANIUM DIOXIDE IN GLASS (PHASE DIAGRAM AND PROPERTIES OF TITANIUM-CONTAINING GLASSES). V. V. Vargin. Doklady Akad. Nauk S.S.S.R. 111, 848-50(1956) Dec. 1. (In Russian)

Phase studies were made of $Na_2O-TiO_2-SiO_2$ to determine the general conformity between the content and properties of Ti containing glasses. (R.V.J.)

3805
CHARACTERISTIC PROPERTIES OF THORIUM OXIDE PARTICLES. V. D. Allred, S. R. Buxton, and J. P. McBride (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 61, 117-20(1957) Jan.

CORROSION

3806 AD-103744
Utah. Univ., Salt Lake City.
KINETICS OF OXIDATION OF METAL POWDERS. Technical Report No. I. H. Edward Flanders. Aug. 1, 1956. 33p. ORD Project No. TA-2-9201. Contract DA1-04-495-501-ORD(P)-19.

The kinetics of oxidation of powders of Mg, Al-Mg, Al, Zr, and Zr-Ni are studied. (T.R.H.)

3807 BMI-HAP-101
Battelle Memorial Inst., Columbus, Ohio.
CORROSION OF BERYLLIUM IN 525°F. AND 600°F. DISTILLED WATER. R. S. Peoples and H. Bulkowski. Sept. 12, 1949. Changed from OFFICIAL USE ONLY Jan. 11, 1957. 17p. Contract [W-7405-eng-92]. $3.30(ph OTS); $2.40(mf OTS).

Corrosion tests were conducted on sintered grade and vacuum-cast extruded Be specimens. Results indicate that the sintered grade is more resistant to disintegration and localized attack than extruded material. (W.L.H.)

3808 BMI-HAP-102
Battelle Memorial Inst., Columbus, Ohio.
CORROSION OF SINTERED AND EXTRUDED BERYLLIUM AT 550°F. IN DISTILLED WATER (1030 psi). R. S. Peoples, H. Bulkowski, and F. W. Fink. Jan. 18, 1950. Changed from OFFICIAL USE ONLY Jan. 11, 1957. 7p. Contract [W-7405-eng-92]. $1.80(ph OTS); $1.80(mf OTS).

Evidence of corrosion damage was found in all samples of sintered and vacuum cast-and-extruded Be. It was concluded from results of tests that 550°F is beyond the safe limit for the material tested. (W.L.H.)

3809 CF-56-10-13
Oak Ridge National Lab., Tenn.
QUARTERLY REPORT OF THE SOLUTION CORROSION GROUP FOR THE PERIOD ENDING OCTOBER 31, 1956. H. C. Savage, J. C. Griess, R. S. Greeley, J. L. English, R. M. Pierce, S. R. Buxton, T. H. Mauney, E. F. House, J. A. Russell, W. C. Ulrich, and D. J. Krause. Oct. 31, 1956. 24p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The 100A loop was operated with proposed HRT solution for 1240 hr. Thermal cycling and mechanical deflection effects on the Zircaloy-stainless steel transition joint and on the expansion joint were studied. Other runs were made on 347 stainless steel under various conditions and to determine the effect of Cr^{6+} on corrosion of stainless steel by UO_2SO_4 solutions. Some corrosion studies were completed on Ta, Zr, Zircaloy-2, Carpenter 20-Nb, and 316 and 347 stainless steel. (T.R.H.)

3810 EES-040028G
Naval Engineering Experiment Station, Annapolis.
STRESS CORROSION OF STAINLESS STEELS IN HIGH TEMPERATURE WATERS. W. Lee Williams. Mar. 25, 1954. 15p. Project NS-200-020.

This report is one of a series dealing with the stress-corrosion cracking of austenitic stainless steels in boiler water environments. Four recent experiments are described. Each involved exposure of the steel in 500°F boiler water vapor. In other respects, the specimens and test conditions varied as follows: expanded tube specimens exposed in the vapor without wetting, expanded tube specimens exposed in the vapor with intermittent wetting and with a vapor phase inhibitor added to the water, strip specimens stressed to various levels between 0 and 50,000 psi and exposed in the vapor with intermittent wetting, and destructive examination of a pressure vessel used in the conduct of stress-corrosion experiments. (auth)

3811 HW-40804
[Hanford Atomic Products Operation, Richland, Wash.]
CORROSION OF TYPES 304-L AND 347 STAINLESS STEEL BY OXALIC ACID. Final Report. W. L. Walker. May 14, 1956. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Data pertaining to the corrosion damage incurred in the use of oxalic acid as a cleaning agent for process equipment are reported. (auth)

3812 HW-42100
Hanford Atomic Products Operation, Richland, Wash.
INHIBITION OF NITRIC ACID CORROSION OF STAINLESS STEEL. Interim Report. W. L. Walker. May 1, 1956. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80 (mf OTS).

An investigation was made to determine the effect of removing NO^- and NO_2^-, on the corrosion rate of a stainless steel in 65 wt. % nitric acid. Samples of type 304-L stainless steel were subjected to a sensitizing heat treatment and exposed in sealed glass capsules to: 65 wt. % nitric acid solutions which contained 0.2M, 0.1M, 0.01M, and 0.001M urea, and solutions of 65 wt. % nitric acid

which had been respectively sparged with O, air, and an inert gas prior to sealing. No inhibitory action was observed for any of these theoretical inhibitors under the conditions of this test. The testing technique was revised to provide for a continuous addition of the inhibitors to a boiling solution of 65 wt. % nitric acid, and the exposures were re-run; with the exception of the inert gas sparge. The results of these exposures indicate that a reduction of corrosion by a factor of three can be achieved by the use of urea in concentrations of 0.2M, and by a factor of two using 0.1M urea. The other concentrations of urea and the gas sparges exhibited insignificant reductions in the corrosion rate. (auth)

3813 HW-46369
Hanford Atomic Products Operation, Richland, Wash.
THE CORROSION OF TYPE 304L STAINLESS STEEL BY SOLUTIONS OF NITRIC ACID–SODIUM DICHROMATE AND NITRIC–HYDROFLUORIC ACIDS. William L. Walker. Oct. 29, 1956. 5p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

3814 HW-46779
[Hanford Atomic Products Operation], Richland, Wash.
CORROSION OF STAINLESS STEEL, TITANIUM, AND TANTALUM IN PLUTONIUM–NITRIC ACID SOLUTIONS. A. Brunstad. [Nov. 27, 1956]. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

3815 WAPD-ReM-16
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PITTING ANODIC CORROSION STUDIES. H. S. Jacket. Nov. 6, 1953. Changed from OFFICIAL USE ONLY Oct. 1, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).

In heat transfer tests on electrically heated reactor fuel element mockups pitting anodic corrosion causes erroneous data and premature element failure. Teflon lining of the channel housing inner wall gave protection up to 600°F. Pyrex glass, lava, and sprayed teflon performed in this order, pyrex glass being second best. (T.R.H.)

3816
STUDY OF A SIZE EFFECT IN GALVANIC CORROSION. James T. Waber (Los Alamos Scientific Lab., N. Mex.). Corrosion 13, 95t-102t(1957) Feb.

Distribution of potential within a corrodent was analyzed using several geometric arrangements of electrodes which lay in a common surface. Polarization was assumed to follow Wagner's useful relation as it varied from point to point on the electrode in response to the local corrosion current. The distribution of the corrosion attack over the anode also was studied. It was found that there was a size effect in the galvanic corrosion studied with the detailed behavior depending to a great extent on whether the electrodes were larger or smaller than Wagner's polarization parameter. It was found also that the potential of a galvanic couple depended on the relative areas of the two electrodes, as well as on their open cell potentials. (auth)

3817
BIBLIOGRAPHIES OF CORROSION PRODUCTS. A. H. Roebuck (Continental Oil Co., Ponca City, Okla.). Corrosion 13, 111t-21t(1957) Feb.

Selected abstracts arranged chronologically with most recent abstracts first are included on the identification and composition of corrosion products on stainless steels, zinc, zirconium, titanium and iron and steel. Included are 43 abstracts on stainless steels; 13 on zinc; 7 on zirconium; 8 on titanium; 130 on iron and steel. The last category includes an alphabetical author list. (auth)

3818
ACTIVITY TRANSPORT IN SODIUM-COOLED SYSTEMS. Fred G. Haag (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 15, No. 2, 58-61(1957) Feb.

An experiment is described in which the transfer rates of Co^{60}, Mn^{54}, Ta^{182}, Fe^{59}, and Cr^{51} from stainless steel by liquid Na are determined. The effect of temperature, O_2 concentration, and various inhibitors is reported. (T.R.H.)

GEOLOGY AND MINERALOGY

3819 BM-IC-7766
Bureau of Mines.
MINING METHODS AND COSTS, STANDARD URANIUM CORP., BIG BUCK MINE, SAN JUAN COUNTY, UTAH. W. L. Dare and R. R. Durk. Oct. 1956. 55p.

One of a series of information circulars describing the methods and costs of operating Big Buck Mine, one of the larger underground U–V ore mines on the Colorado Plateau, is presented. (J.E.D.)

3820 RME-3117
Bureau of Mines and Geological Survey.
MONAZITE PLACER AT THE JUNCTION OF THE NORTH TYGER RIVER WITH THE MIDDLE TYGER RIVER, SPARTANBURG COUNTY, SOUTH CAROLINA. Leland A. Hansen and Norman P. Cuppels. Jan. 1955. 23p. $0.25 (OTS).

The North Tyger River placer contains an estimated 33.7 million yd^3 of alluvium, the bulk of which consists of sand and fine-grained sediments. The hornblende gneiss is less resistant to erosion than the granite gneiss or the porphyritic granite, and the North Tyger River has widened its valley where it crosses the area underlain by hornblende gneiss. This wide valley contains the placer. Although monazite is irregularly distributed in the flood plain, the higher-tenor deposits are in the basal sediments near the middle of the valley. The heavy mineral content of the placer ranges from 5.44 to 15.39 and averages 9.35 lb/yd^3. Monazite by chemical analysis ranges from 0.16 to 1.08 and averages 0.39 lb/yd^3. Percentagewise the deposit contains 0.35% heavy of the heavy minerals. Overall tonnages show the deposit contains about 157,500 short tons of black sand with 6,570 tons of monazite. Other minerals are estimated as follows: ilmenite, 51,200 tons; rutile, 2,100 tons; zircon, 13,400 tons; garnet, 23,600 tons. Sixteen holes were drilled for a total depth of 337 ft and an average of 21 ft. Three drill lines were selected to represent the flood plains, and drill holes were spaced to average the distance. The project was a continuation of similar monazite investigations in the same general area. A brief summary of some spot check drilling on the Pacolet River, Spartanburg Co., S. C. is appended. (auth)

3821 RME-3130
Bureau of Mines.
BEAR VALLEY RADIOACTIVE MINERAL PLACERS, VALLEY COUNTY, IDAHO. M. H. Kline, E. J. Carlson, R. H. Storch, and A. F. Robertson. Oct. 1953. p. $0.25.

Three areas, Upper, Central, and Lower Bear Valley in Valley Co., Idaho, were explored for radioactive minerals. A total of 83 churn-drill holes, ranging in depth from 9 to 120 ft, was drilled. Nine hundred and seventy-one samples weighing 89,779 lbs were obtained from the drill holes for testing and analyzing. A number of minerals having variable amounts of U and Th were found in the black-sand concentrates obtained from churn drilling. Of these, the more prominent were monazite and euxenite, with minor amounts of samarskite fergusonite, xenotime, zircon, allanite and radioactive sphene. The minimum and maximum range limits of the important black-sand minerals

per yd^3 of gravel are tabulated. Each area was found to have a very large volume of comparatively small-size gravel and abundant water. The drilling by the Bureau of Mines indicated that substantial quantities of monazite, columbite, and radioactive opaque minerals are contained in the gravels of Bear Valley. (auth)

3822 RME-3132
Bureau of Mines.
BEAVER CREEK MONAZITE PLACER AREA, VALLEY COUNTY, IDAHO. R. H. Storch and A. F. Robertson. June 1954. 15p.

Sixteen churn-drill holes were drilled in the Beaver Creek area and almost 11 tons of samples were obtained for analyzing. The results from laboratory analyses indicated that the monazite content of the gravels ranged from 0.188 to 0.847 lb/yd^3 of gravel. The prospected area is only a small part of the total placer area, so the volume of minable gravel is large. Laboratory tests on the drill-hole samples indicated that monazite was present in nearly all of the samples, but no drill hole averaged as much as a pound of monazite per yd^3 of gravel. No extensive deposit containing monazite in large quantities was intersected by any of the drill holes. Possibly further drilling adjacent to the area prospected might locate deposits with higher monazite content. A screen analysis indicated that over 60% of the monazite occurs in sizes less than 65-mesh. Other than monazite, radiometric tests indicated only trace-amounts of other radiometric minerals. In addition to monazite the black-sand concentrates contained ilmenite, quartz, feldspar, and so forth, and also small quantities of magnetite, zircon, and garnet. (auth)

3823 RME-3135
Bureau of Mines.
CORRAL CREEK MONAZITE PLACER AREA, VALLEY COUNTY, IDAHO. M. H. Kline, E. J. Carlson, and H. W. Horst. Jan. 1955. 22p.

Sixty-one churn-drill holes, ranging in depth from 20 to 123 ft and aggregating 3,518 ft, were drilled in the Corral Creek area. A total of 773 samples, weighing almost 35 tons, was obtained for testing and analyzing. The area outlined by drilling was about 2 miles in length (north and south) and 1.5 miles in width. For the 61 holes drilled, the black-sand concentrates ranged from 0.29 to 14.94 lb/yd^3 of gravel. By chemical analyses, these black sands were found to contain between 4.2 and 38.3% monazite by weight for the samples analyzed. More than a third of the large area was found to have richer values of monazite in the black-sands. For this smaller area, the black sands varied from 1.87 to 14.94 lb/yd^3 of gravel, and by chemical analyses these sands ranged from 11.4 to 37.8% monazite by weight. Chemical analyses of monazite from this field indicated a content of 4.39% ThO_2 and 0.10% U_3O_8. In addition to monazite, the black sands were found to contain a large percentage of ilmenite, and much smaller percentages of magnetite, garnet, and zircon. (auth)

3824 RME-3136
Bureau of Mines.
CAMP CREEK RADIOACTIVE MINERAL PLACER AREA, BLAINE AND CAMAS COUNTIES, IDAHO. Almon F. Robertson and R. H. Storch. June 1955. 25p. $0.25(OTS).

Thirty-seven churn drill holes, ranging in depth from 25 to 70 ft were drilled, and 24 test pits, varying in depth from 3 to 17 ft were excavated in the Camp Creek area. In addition, 3 churn-drill holes averaging more than 38 ft in depth and containing only trace amounts of radioactive minerals were drilled in the Willow Creek area. A total of 337 samples weighing over 13 tons was obtained from the drilling and test pitting exploration work in the Camp Creek area. Sufficient water for a year-round dredging operation is not available in Camp Creek, so water for mining operations during late summer, fall, and winter seasons would have to be obtained from other sources in the vicinity. A plentiful supply of water, and possibly special equipment, would be necessary to recover the black-sand minerals from the interbedded gravels and sticky clays. Clean uranothorite separated from 4 selected samples was found to contain 51.92% ThO_2 and 5.54% U_3O_8. The sphene, in the Camp Creek gravels, is essentially a calcium titanium silicate containing approximately 40% TiO_2. X-ray-spectrographic analyses of 4 samples of clean sphene showed it to contain an average of about 1.78% Cb_2O_5 and less than 0.5% Ta_2O_5. In addition, the sphene contained about 0.6% Y and less than 0.1% Tm. The separation of the black-sand minerals into their several constituents might be difficult because of the included and attached minerals associated with uranothorite and sphene. (auth)

3825 RME-3140
Bureau of Mines.
A COMPREHENSIVE REPORT OF EXPLORATION BY THE BUREAU OF MINES FOR THORIUM AND RADIOACTIVE BLACK MINERAL DEPOSITS. D. E. Eilertsen and F. D. Lamb, comps. June 1956. 46p. $0.30(OTS).

In the search for Th and radioactive black minerals in the U.S. and Alaska, exploration work was done on 49 projects. All of the deposits investigated were placers except one, in Wyoming, which is a lode deposit. These investigations were in addition to hundreds of preliminary examinations of deposits made during field reconnaissance work. Of the 39 deposits in the western part of the United States and Alaska, the Bear Valley deposit in Idaho is the only one being commercially exploited at the present time. Among the other areas investigated, 9 deposits, 8 in Idaho, and 1 in Montana, contain radioactive and other minerals of potential commercial importance. The Bear Valley placers in Idaho and the Victor and McCalla placer in Montana, were the only two areas considered to have inferred reserves of radioactive minerals. The total indicated and inferred reserves of radioactive minerals in the areas are shown. The tenors of radioactive minerals in the two Alaskan deposits investigated were found to be too low to be of economic importance. The Southeastern States exploration work, was conducted on ten placer deposits. All of the deposits investigated were found to be marginal in grade, but during exploration on Hollow Creek, Aiken County, South Carolina four prospect holes were drilled by the Bureau in an adjacent area, lower Horse Creek. The results obtained from these holes encouraged outside interests to do some additional exploration in the area with Bureau of Mines advice and assistance. During this program a few holes were also drilled on upper Horse Creek which indicated that the better ground was upstream. Later a DMEA loan application, submitted by other outside interests was approved and further drilling in the area indicated the gravels to contain economic quantities of monazite, xenotime, and other heavy minerals. As a result, Marine Minerals, Incorporated was established to exploit the deposit. (auth)

3826
PARAGENESIS AND STRUCTURE OF PITCHBLENDE-BEARING VEINS, CENTRAL CITY DISTRICT, GILPIN COUNTY, COLORADO. Paul K. Sims (U. S. Geol. Survey, Denver, Colo.). Econ. Geol. 51, 739-56(1956) Dec.

Pitchblende occurs locally along early Tertiary gold-, silver-, and sulfide-bearing quartz veins in the Central City district, Colorado, within the mineral belt of the Front Range. The veins cut a complex mass of Precambrian metamorphic and igneous rocks and early Tertiary intrusive porphyritic rocks. The veins are fissure fillings that formed at intermediate temperatures and pressures. They consist

mainly of pyrite, sphalerite, and galena in a quartz gangue, but also contain tennantite, chalcopyrite, enargite, and pitchblende. The veins differ in quantitative mineralogy, and they can be classified as pyrite-type and galena-sphalerite-type veins. (auth)

3827
THE THERMAL EXPANSIONS OF THORIA, PERICLASE AND DIAMOND. Brian J. Skinner (Harvard Univ., Cambridge, Mass.). Am. Mineralogist 42, 39-55(1957) Jan.–Feb.

3828
STORAGE OF ENERGY IN METAMICT MINERALS. Sheldon F. Kurath (Univ. of Wisconsin, Madison). Am. Mineralogist 42, 91-9(1957) Jan.–Feb.

A number of radioactive minerals have been studied by means of differential thermal analysis. The amount of heat evolved in heating under nitrogen and the radioactivity of these minerals have been quantitatively determined. (auth)

3829
URANOTHORITE NEAR FOREST HOME, SAN BERNARDINO COUNTY, CALIFORNIA. D. F. Hewett and Jerome Stone (U. S. Geological Survey, Washington). Am. Mineralogist 42, 104-7(1957) Jan.–Feb.

Some uncommon U and Th minerals occurring under unique geological conditions have been discovered near Forest Home, south of San Bernardino Mountain. The uranothorite was found in an open cut on the east slope of Alger Creek Valley about 300 feet above the creek and 3,000 ft from the point where Alger Creek joins Mill Creek. The explored body of reddish-brown rock consists largely of feldspar and quartz with sporadic lenses of dark mineral, which is mostly magnetite containing small crystals and grains of allanite, uranothorite, and zircon. (R.V.J.)

3830
URANIUM DEPOSITS IN OOLITIC LIMESTONE NEAR MAYOWORTH, JOHNSON COUNTY, WYOMING. R. R. Guilinger and P. K. Theobald. U. S. Geol. Survey Bull. 1030-K. 1957. 10p.

The uranium deposits of the Mayoworth area, Johnson Co., Wyo., are in oolitic limestone at the base of the Sundance formation of Late Jurassic age. The uranium mineral has been identified as metatyuyamunite, a hydrous calcium uranium vanadate that coats joints and fractures and replaces calcite in both the cement and the oolites. In the largest area of measured radioactivity, the deposits are coatings on joint surfaces, but in the other areas, replacement of oolites and cement is most common. Some of the uranium may be syngenetic. Secondary metatyuyamunite has been concentrated along groundwater channels. The uranium content ranges from 0.017 to 0.32% and the V_2O_5 content ranges from 0.06 to 0.17%. The known deposits of the area are of sub-ore grade and are not of economic importance at this time. (auth)

METALS AND METALLURGY

3831 A-2293(WEC)
Westinghouse Electric Corp. Aviation Gas Turbine Div., Kansas City, Mo.
DEVELOPMENT OF NIOBIUM BASE ALLOYS. Quarterly Progress Report No. 4 [for] September 15 to December 15, 1956. R. T. Begley. Jan. 1, 1957. 50p. Contract AF33(616)-3316.

Creep-rupture properties of annealed and cold-worked, commercially-pure Nb were determined at 1800 (982°C) and 2000°F (1093°C). The annealed and cold-worked specimens exhibited comparable strengths, with the annealed material being somewhat stronger at all stress levels. Data on the oxidation behavior of Nb in the range from 350 to 525°C are reported. Testing was accomplished in 0.1 atmosphere pressure of O. The flow and fracture characteristics of Nb were determined from 300 to −196°C. Annealing treatment influenced the ductile-to-brittle transition temperature. Hardness and bend test data are reported on Nb welded in A, A plus N, and A plus O. Development of analytical techniques for the determination of metallic and nonmetallic impurities in Nb continued. (auth)

3832 AD-75227
Illinois Inst. of Tech., Chicago.
LITERATURE SURVEY ON THE DIFFUSION OF METALS INTO OXIDES. Period Covered: 1946–1952. Progress Report No. 1. James Lommel. Dec. 15, 1953. 22p. LIT Project No. 6078. Contract NOrd-13883.

3833 AD-103367
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DESENSITIZATION OF ZIRCONIUM POWDER. Progress Report No. 5 [for] December 17, 1955 to January 16, 1956. O. W. Adams and W. C. McCrone. Jan. 24, 1956. 10p. ARF Project No. C-079. Contract N-60921-s-3378.

3834 AGC-AE-17
Aerojet General Corp., Azusa, Calif.
THE REACTION OF MOLTEN URANIUM AND ZIRCONIUM ALLOYS WITH WATER. Interim Summary Report from March 15, 1955 through March 15, 1956. H. M. Higgins. Apr. 30, 1956. Decl. Jan. 15, 1957. 48p. Contract AT(04-3)-44. (AGC-2914-2). $0.45(OTS).

The molten metals U and Al and alloys of Mo–U, U–Zr, and Zircaloy-B were dispersed in water in order to determine if the reaction of these materials would go to completion and if the reactions were explosive in character. Test data substantiated predictions based on theory that droplet size and metal temperature were important factors in determining the extent and violence of the reactions. Zr-base alloys were found to react violently under certain conditions, whereas U and U alloys reacted less violently under the same conditions. Small percentages of Be were added to Zircaloy-B in an effort to reduce its reactivity. This effort was successful in that several of the resulting alloys were less reactive. (auth)

3835 AGC-AE-33
Aerojet General Corp., Azusa, Calif.
THE REACTION OF MOLTEN METAL WITH WATER. Progress Report [for] December 1 through December 31, 1956. Jan. 28, 1957. 3p. Contract AT(04-3)-44. (AGC-L2914-22). $1.80(ph OTS); $1.80(mf OTS).

Explosion dynamometer tests have been performed with molten Zr. (For preceding period see AGC-AE-29.) (W.L.H.)

3836 CF-51-1-23
Oak Ridge National Lab., Tenn.
WELDING ALUMINUM BY THE ARGON-ARC TECHNIQUE. S. E. Beall. Jan. 10, 1951. Changed from OFFICIAL USE ONLY Dec. 10, 1956. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

3837 COO-310
Brush Beryllium Co., Cleveland.
BRAZING BERYLLIUM TUBING TO HIGH-TEMPERATURE ALLOY COLLARS. K. G. Wikle and R. Magalski. June 1956. 22p. Contract AT(30-1)-541. $0.20(OTS).

A vacuum-furnace brazing technique by which beryllium tubes can be lap brazed to 405 stainless steel and other high-temperature alloys has been developed. This is accomplished by pre-placing BT braze alloy between cleaned joint surfaces, imposing a small mechanical pressure on the joint, and heating to about 1470°F in a vacuum (<1 μ).

The resultant lap joints have a shear strength up to about 7,000 to 8,000 psi at 750°F. Six brazed tube assemblies were prepared according to specifications. (auth)

3838 DP-169
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
RESIDUAL STRESSES IN THORIUM SLUGS. J. Walter Joseph, Jr. and John W. Walker. Sept. 1956. 28p. Contract AT(07-2)-1. $0.25(OTS).

Residual stresses of 2000 to 8000 psi in compression were measured at the surface of cylindrical slugs of Th. The stresses were measured by boring holes in the slugs and measuring the resulting surface deformation with strain gages. The tensile stresses that result from thermal gradients in the slugs during irradiation are partially counteracted by these residual stresses. (auth)

3839 EES-040038B(3)
Naval Engineering Experiment Station, Annapolis.
HIGH TEMPERATURE PROPERTIES OF A 12 CR–3 MO–0.25 V STEEL. R. B. Niederberger. Oct. 17, 1955. 14p. Project NS-013-120.

The tension, stress-rupture and creep properties at 1000 and 1100°F are reported for a modified 12% Cr steel containing 3% Mo and 0.25% V. The material was oil quenched from 1900°F and tempered at 1200°F. For comparative data, a few tests were repeated with material tempered at 1350°F. In comparison with other modified 12% Cr alloys tested previously, this steel possesses the highest rupture strength, along with fairly good creep resistance. The higher tempering temperature results in reduced tensile and rupture properties without appreciable effect on creep strength. (auth)

3840 HW-41372
Hanford Atomic Products Operation, Richland, Wash.
A STUDY OF THE SHORT TIME ANNEALING OF COLD WORKED ZIRCONIUM. D. E. Johnson. Feb. 29, 1956. 33p. $0.30(OTS).

The mechanical properties of cold worked and annealed Zr were determined after short time and long time annealing treatments in a salt bath and in an inert atmosphere. It was concluded that very short time annealing of cold worked Zr is as effective in restoring good ductility to the material as are relatively long time annealing treatments; for 25% cold worked Zr the optimum ductility, as determined by elongation and reduction in area in a tensile test, was obtained with annealing treatments of one minute at 750°C in a salt bath followed by a water quench; for 65% cold worked Zr the annealing treatment for best ductility was determined to be one-half minute at 750°C in a salt bath followed by a water quench; recrystallization of cold worked Zr is complete after two minutes at 750°C. (auth)

3841 HW-41772
Hanford Atomic Products Operation, Richland, Wash.
PREFERRED ORIENTATION IN UNISKANNED ZIRCONIUM. W. V. Cummings and E. N. Kling. Mar. 5, 1956. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80 (mf OTS).

3842 HW-42075
Hanford Atomic Products Operation, Richland, Wash.
CRACK SENSITIVITY OF TYPE 308L AND 347 METAL ARC WELD DEPOSITS. W. R. Smith, L. C. Lemon, and J. J. Sako. Mar. 19, 1956. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Only one electrode produced a weld deposit whose chemical composition was such that weld cracking would normally be expected to occur and this weld did crack in the test. A welding technique was employed which would maximize the tendency for the weld craters to crack and as a result the three type 347 welds displayed deep crater cracks and seven of the eleven type 308L welds showed some surface shrinkage and fissuring. The testing techniques employed indicate that the electrodes which made deposits containing ferrite and as a result are magnetic, do not tend to crack. The electrodes studied did not cover a wide range of compositions and the only conclusion which can be drawn from the results is that no difference in cracking tendency appears to exist between type E308L-15 and E308L-16 electrodes if the chemical compositions are within standard limits. (auth)

3843 K-1288
Oak Ridge Gaseous Diffusion Plant, Tenn.
PREPARATION AND TESTING OF A TITANIUM-LINED PIPE SECTION FOR STANDARD RING-JOINT GASKETS. V. M. Hovis, R. C. Kinser, R. G. Trehearne, and D. B. Woodbridge. Jan. 23, 1957. 33p. Contract W-7405-eng-26. $0.30(OTS).

A 12-in.-long steel pipe section (3-in., schedule 160) in the form of a spool piece having flanges grooved for standard 2500-psi ring-joint gaskets was fitted with a linear made from welded Ti tube with a $\frac{1}{16}$-in. wall and a $2\frac{1}{2}$-in. inside diameter. A satisfactory hot-spinning technique for extending the Ti out over the flanges was developed and is described. Testing the section with repeated pressure-temperature cycles to 2,000 psi and 600°F. demonstrated that a satisfactory leak-tight joint could be obtained with this design. Gaskets of 304 stainless steel gold plated were mechanically satisfactory and permitted repeated reassembly of the test section without damage to the Ti liner. (auth)

3844 KAPL-M-DND-2
Knolls Atomic Power Lab., Schenectady, N. Y.
EVALUATION OF THE HAFNIUM MELTING, FORGING, AND ROLLING WORK CONDUCTED BY THE CRANE COMPANY. Donald N. Dunning. Jan. 22, 1957. 23p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The preliminary conclusions drawn on the data available to date are made to determine feasibility of continuing Hf fabrication with the present procedures. Confirmation of all data will be necessary to properly evaluate all the factors involved. The preliminary conclusions are: The Hf melting procedures, modified to embody vacuum melting and a full starter plate, appear extremely promising for consistent sound metal fabrication, and the material fabricated to date by these revised procedures is of excellent quality. (auth)

3845 LM/TAB-3
Mine Safety Appliances Co., Callery, Penna.
LIQUID METALS TECHNOLOGY ABSTRACT BULLETIN FOR THE PERIOD NOVEMBER 1 TO DECEMBER 31, 1956. Jan. 8, 1957. 36p.

3846 NYO-3500
Arcos Corp., Philadelphia.
THE WELDING OF TYPE 347 STEELS. STATISTICAL ANALYSIS OF EFFECTS OF VARIOUS ELEMENTS ON THE CRACK SENSITIVITY OF FULLY AUSTENITIC TYPE 347 WELDS. Arthur Hoerl and Thomas J. Moore. Oct. 29, 1956. 26p. Contract [AT(30-1)-1233]. $0.25 (OTS).

The program reported is only concerned with the cracking tendency of fully austenitic Type 347 weld metal. None of the weld metal compositions investigated contained any ferrite. By using a sensitive segmented circular groove cracking test, and a statistical interpretation of the effect of varying specific elements, a closer approximation to the ideal composition of a crack resistant fully austenitic Type 347 weld metal has been realized. C and Mn are shown to be the most potent elements in reducing cracking,

and P and S are the strongest and most definite crack promoters. Silicon appears to have less effect in promoting cracking than was thought heretofore. The composition of the base material as well as the electrode was considered in calculating the weld bead chemistry which was used in the statistical study. All electrodes used in these tests employed a lime-type covering. (auth)

3847 TID-4005(Pt. I, 4th Ed.)
Division of Research, AEC.
SUMMARIES OF PHYSICAL RESEARCH IN METALLURGY, SOLID STATE PHYSICS, AND CERAMICS. Edward Epremian, ed. Jan. 1957. 137p. $0.65(OTS).

Brief summaries of research programs, totally or partially supported by the AEC, in the fields of ceramics, metallurgy, and solid state physics are presented. Both subject and contractor indexes are appended. (D.E.B.)

3848 TML-62
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
A STUDY OF FREEZING SEGREGATION IN TITANIUM ALLOY INGOTS. J. W. Holladay. Jan. 15, 1957. 51p. Contract AF18(600)-1375.

Nonuniformity of mechanical properties and of homogeneity of chemical composition in Ti alloy semimanufactures are problems of concern to the industry. A theoretical study was undertaken, therefore, to determine whether the nonuniformity might be attributable to freezing segregation. The theories of normal freezing and of zone melting were applied to Ti alloy ingots produced by consumable-electrode melting in a cold-mold furnace, and to ingots produced by casting from a skull furnace. The results of the theoretical analysis are compared with the limited amount of available experimental data. (auth)

3849 WADC-TR-54-214(Pt. 1)
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
ELEVATED-TEMPERATURE TESTING PROCEDURES. PART 1. CONTINUOUS RECORDING OF TIME-DEFORMATION READINGS DURING CREEP-RUPTURE TESTING AT TEMPERATURES UP TO 1200°F. William H. Rector and Charles A. Townsley. Feb. 1955. 12p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. (AD-63270).

A new method of recording deformation during creep-rupture testing at temperatures up to 1200°F is presented. This method has the advantages of: obtaining a continuous time-deformation record up to failure, compared to the intermittent readings obtained using the former manual method and being completely automatic and saving the technician's time required to make manual measurements. This method employs cameras to record the data. A description of the equipment is given. (auth)

3850 WADC-TR-54-355(Pt. III)
Battelle Memorial Inst., Columbus, Ohio.
PRECIPITATION HARDENING AND EMBRITTLEMENT OF HIGH-STRENGTH TITANIUM ALLOYS. Period Covered: March 1, 1955 to May 31, 1956. A. J. Griest, J. R. Doig, P. D. Frost, and C. M. Schwartz. Aug. 31, 1956. 90p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-445. (AD-110583).

The age-hardening behavior of a series of alpha-beta Ti alloys was investigated. Hardness, tensile, and x-ray-diffraction data were used in following the course of the aging behavior of alloys of the systems Ti–Mn, Ti–Mn–Al, Ti–V, Ti–V–Al, and Ti–Fe. The data presented show the effects of solution temperature, aging temperature and alloy composition on the aging reaction. Comparison of the data for the nominal alloys Ti–8Mn and Ti8–Mn–2Al, as well as other data, indicate that the effect of Al is to cause the peak strength and hardness to be maintained over longer aging times and to apparently weaken the tendency for omega phase formation. In a separate phase of the research, a survey was made of possible contributing factors to beta embrittlement (the low ductility characteristic of high-strength alpha-beta alloys after fabrication or heat treatment in the beta field). It was noted that beta-embrittled materials generally have a combination of microstructural features, such as coarse prior beta grain size or acicular alpha precipitates, which might be expected to impair ductility, especially at high strength levels. (auth)

3851 WADC-TR-55-199(Pt.2)
Southern Research Inst., Birmingham, Ala.
TENSILE PROPERTIES OF AIRCRAFT-STRUCTURAL METALS AT VARIOUS RATES OF LOADING AFTER RAPID HEATING. [Period Covered] November 1954 to April 1956. Joseph D. Morrison and J. Robert Kattus. Aug. 1956. 201p. Project Title: MATERIAL ANALYSIS AND EVALUATION TECHNIQUES. Task Title: DESIGN AND EVALUATION DATA FOR STRUCTURAL METALS. Contract AF33(616)-424. (AD-110540).

The effects of variations in strain rate and holding time on the tensile properties of several aircraft-structural metals after they had been heated within 10 seconds to test temperatures up to 1200°F are determined. The work was primarily directed toward determining these effects on the yield and ultimate strength. Other properties such as modulus of elasticity, proportional limit and total elongation were also determined but only as by-products and for the purpose of establishing trends. These properties should be used only after careful consideration of the complex conditions under which they were obtained. This investigation covered strain rates from 0.00005 in./in./sec to 1.0 in./in./sec, holding times at test temperature from 10 sec to 30 min, and the following materials: sheet metals: annealed Stellite-25, precipitation-hardened Inconel-X, half-hard and full-hard Type 301 stainless steel, 17-7PH stainless steel in both the annealed and the TH 1050 conditions, AISI-4130 steel in both the normalized and the quenched and tempered conditions, hot-rolled SAE-1020 steel, and A110-AT and Ti-140A Ti alloys, and cast metals: ZH-62T5 Mg alloy and 356-T6 Al alloy. With a few exceptions, the strength properties of the test metals increased appreciably with increasing strain rates, whereas percent elongation reacted erratically to changes in strain rate and modulus of elasticity was affected only slightly. At certain temperatures and strain rates, variations in holding time significantly affected the strength and ductility of 356-T6 Al alloy and affected only to a minor degree the strength of Inconel-X, full-hard Type 301 stainless steel, both normalized and heat-treated AISI-4130 steel, and 17-7PH-TH1050 stainless steel. These effects are believed to be caused by structural changes. Variations in holding time had no effect on the properties of the other alloys. Up to 1000°F, Type 17-7PH-TH1050 stainless steel was the strongest material tested, but above 1000°F precipitation-hardened Inconel-X was the strongest. (auth)

3852 WADC-TR-56-181
Minnesota. Univ., Minneapolis.
FATIGUE, CREEP, AND RUPTURE PROPERTIES OF HEAT RESISTANT MATERIALS. Period covered: June 1953 to December 1955. F. H. Vitovec and B. J. Lazan. Aug. 1956. 212p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE PROPERTIES OF STRUCTURAL MATERIALS. Contract AF33(616)-2803. (AD-97240).

Fatigue, rupture, and creep data at various temperatures obtained under various combinations of mean and alternating stress are presented for the alloys Stellite 31, S-816, 6.3% Mo–Waspalloy, 7% Mo–Waspalloy, M-252, Inconel X-550, 16-25-6 Timken, Crucible 422, Lapelloy and Stainless type 403. Tests were performed under axial stress on unnotched specimens and specimens having theoretical stress concentration factors of 2.4 and 3.4. The data are presented as S-N curves and stress range diagrams to show the effect on the fatigue and creep properties of specimen notch, temperature, ratio of alternating-to-mean stress, and stress magnitude. The role of both creep and fatigue as design factors and the relation of notch sensitivity to loading conditions are discussed with particular reference to temperature and ratio of alternating-to-mean stress. (auth)

3853 WADC-TR-56-269

Battelle Memorial Inst., Columbus, Ohio.

AN INVESTIGATION OF THE USEFULNESS OF ELECTRON MICROSCOPY IN THE STUDY OF TITANIUM-ALLOY STRUCTURES. Period Covered: March 1955 to March 1956. Frank C. Holden, Arthur P. Young, Horace R. Ogden, Charles M. Schwartz, and Robert I. Jaffee. Mar. 1956. 56p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2900. (AD-110460).

The electron microscope has been found useful in the study of a number of Ti-alloy structures. Those structures that contain fine particles or that otherwise require high magnification and resolution for complete study are candidates for electron microscopy. Among the subjects investigated, three appeared of particular interest: the decomposition of martensite, the aging process in alpha-beta and beta alloys, and studies of deformation processes in two-phase alloys. Suitable techniques for electron microscopy already have been developed, but further work is desirable. It seems probable that the electron microscope will take its place among the other useful tools in the research on Ti alloys. (auth)

3854 WAPD-LSR(FE)-3

Westinghouse [Electric Corp.] Atomic Power Div., Pittsburgh.

HOT MALLEABILITY OF ZIRCALOY-2 AND HIGH ZIRCONIUM–URANIUM ALLOYS. R. E. Droegkamp. Feb. 5, 1955. Changed from OFFICIAL USE ONLY Oct. 3, 1956. 19p. $3.30(ph OTS); $2.40(mf OTS).

One-inch cube and one-inch cylindrical specimens of Zircaloy-2 and the 50, 60, 70, and 80 wt. % Zr-U alloys was hot compression tested at 1600, 1500, 1350, 1250, 1150, and 1000°F. The technique is an adaptation of a hot malleability test used on Ni alloys. It was found that Zircaloy-2 showed poor malleability at certain temperatures by edge cracking in the direction of upset, a type of failure very similar to that found in Ni alloys. The data indicate that Zircaloy-2 has good malleability as low as 1500°F at all reductions, and at temperatures as low as 1000°F if reductions are limited to 50%. The Zr-U alloys showed good malleability at all temperatures except 1000°F, where specimens failed in shear. It is felt that this type of hot compression test needs some refinement as to method and interpretation of results when used on Zr-U alloys, since limited fabrication results indicate that there is a difference in rolling and forging characteristics at these temperatures which are not brought out by hot malleability results. Data did reveal that greater reductions could be taken resulting in more uniform metal flow and a greater yield. (auth)

3855 Y-F30-1

[Oak Ridge National Lab., Y-12 Area, Tenn.]

REPORT ON TEST OF EXTINGUISHING AGENTS FOR LITHIUM METAL FIRES. E. S. Wilson and P. O. Nadler. June 18, 1951. Changed from OFFICIAL USE ONLY Dec. 7, 1956. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

3856 AEC-tr-2813

THE MELTING TEMPERATURES OF ZINC, CADMIUM, THALLIUM, AND ANTIMONY AT PRESSURES UP TO 30,000 Kg/cm^2. V. P. Butuzov, E. G. Ponyatovskij, and G. P. Shakhovskoj. Translated from Doklady Akad. Nauk S.S.S.R. 109, 519(1956). 3p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11-1533. (J.E.D.)

3857 AEC-tr-2816

SONIC AND ULTRASONIC DEGASSING OF ALUMINUM (AND ITS ALLOYS). Th. Rummel, W. Esmarch, and K. Beuther. Translated by K. S. Bevis from Metallwirtschaft 19, 1029-33(1940). 11p.

Sonic or ultrasonic waves degas Al. A frequency effect is not determinable from 50 to 10,000 hertz. The Al–Mg alloys are degassed only with great difficulty. (T.R.H.)

3858

THE STRUCTURE OF THORIUM–MAGNESIUM INTERMETALLIC COMPOUNDS. D. T. Peterson, P. F. Diljak, and C. L. Vold (Iowa State College, Ames). Acta Cryst. 9, 1036(1956) Dec.

3859

INVESTIGATIONS OF METALLIC COMPOUNDS IN NICKEL ALLOYS CONTAINING ALUMINUM. R. B. Golubtsova and L. A. Mashkovich (Baĭkov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 111, 824-6(1956) Dec. 1. (In Russian)

Intermetallic analysis was made to determine the metallic compounds forming in Ni–Al, Ni–Al–Cr, and Ni–Al–Cr–Ti in thermal treatment up to 1200°. The values of potentials of Ni_3Al phase and solid solutions in various electrolytes have been studied. The results of chemical analysis of the anode dust of the binary, triple, and quadruple alloys are presented in a tabulated form showing that Cr and Ti in the investigated quantities do not effect the melting properties of the alloys. The ratio of Ni to Al in wt. and at. % agree with the theoretical Ni_3Al formula where Ni : Al = 6.52(wt. %) and Ni : Al = 3.0(at. %). (R.V.J.)

3860

EFFECTS OF STRUCTURE OF ALLOYS ON THE PROCESS OF DIFFUSION. L. M. Mirskiĭ. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 11, 40-51(1956) Nov. (In Russian)

Investigations were made of the temperature effects on the rate of diffusion using various parameters to calculate the physical process. The distribution of diffusing components of the system over the volume and border of the grain and the mechanism of the process were studied in association with each other. (auth)

3861

EFFECTS OF ALLOYING ELEMENTS ON THE HARDNESS OF NICKEL ALLOYS AT ELEVATED TEMPERATURES. M. E. Blanter, L. I. Kuznetsov, M. G. Lozinskiĭ, and E. P. Sinodova (Moscow Aviation Inst.) Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 12, 88-95(1956) Dec. (In Russian)

Effects of Cr, W, Mo, Ti, Co, and Al on the hardness of Ni alloys at temperature levels from room to 1100°C were evaluated. (R.V.J.)

3862

THE MECHANISM OF DEPOSITION OF TITANIUM COATINGS FROM FUSED SALT BATHS. M. E. Straumanis, S. T. Shih, and A. W. Schlechten (Univ. of Missouri School of

Mines and Metallurgy, Rolla). J. Electrochem. Soc. 104, 17-20(1957) Jan.

The mechanism of the titanizing process, as described previously, consists mainly in the direct collision of Ti particles dispersed in a molten salt bath (KCl, NaCl, or both together) with the surface of the metallic or ceramic object submerged. The Ti particles stick to the surface, and, if the temperature is high enough (e.g., for Fe above 910°C) a part of the Ti deposited diffuses into the substrate forming a diffusion layer. Its thickness conforms to Rhines' diffusion equation. By the titanizing method described not only can Fe, low carbon steel, Co, Ni, and noble metals be coated, but so can ceramic materials such as porcelain and alundum. Coatings on Fe can also be produced in fused salts (KCl or NaCl) containing lower Ti chlorides in larger amounts but no metallic Ti. In this case the coating is produced by an exchange mechanism, e.g., $2TiCl_3 + 3Fe \rightarrow 3FeCl_2 + 2Ti$ (coating on excess Fe), or by Ti formed in the $TiCl_3$ disproportionation reaction. The collision mechanism and the exchange mechanism may go on simultaneously with more active metals. However, not more than 4.0% of the total Ti coating is produced by the latter mechanism. The lower Ti chlorides in the fused salt baths are formed by the reaction $Ti + 3NaCl \rightarrow TiCl_3 + 3Na$; the Na evaporates partially at the working temperature of above 900°C. (auth)

3863

ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. III. PREPARATION AND ELECTROLYSIS OF TITANIUM AND ZIRCONIUM COMPOUNDS IN NONAQUEOUS MEDIA. W. E. Reid, Jr., J. M. Bish, and Abner Brenner (National Bureau of Standards, Washington). J. Electrochem. Soc. 104, 21-9(1957) Jan.

Numerous nonaqueous solutions of Ti and Zr compounds were electrolyzed in an attempt to electrodeposit the metals. Ether solutions containing halides, hydrides, borohydrides, and organo-metallic compounds of Ti and Zr were the most promising. A mixed type of bath containing both hydrides and borohydrides yielded Ti–Al alloys containing about 6% Ti. Similar baths containing Zr instead of Ti gave alloy deposits containing up to 45% Zr. New methods of preparation of titanium and zirconium borohydrides were developed. (auth)

3864

ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. IV. ELECTRODEPOSITION OF BERYLLIUM AND BERYLLIUM ALLOYS. Gwendolyn B. Wood and Abner Brenner (National Bureau of Standards, Washington). J. Electrochem. Soc. 104, 29-37(1957) Jan.

The electrodeposition of Be from nonaqueous media was studied. Be compounds used as solutes were the hydride, aluminohydride, borohydride, halides, alkyls, and aryls. Their preparation, chemical properties, and electrochemical properties in nonaqueous media were investigated. Electrodeposits of Be (95% pure) and Be alloys, such as Be–B and Be–Al, were obtained from organic solutions. It is believed that these represent the first metallic deposits consisting essentially of Be that have been obtained from organic baths. (auth)

3865

ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. V. ELECTRODEPOSITION OF MAGNESIUM AND MAGNESIUM ALLOYS. Jean H. Conner, Walter E. Reid, Jr., and Gwendolyn B. Wood (National Bureau of Standards, Washington). J. Electrochem. Soc. 104, 38-41(1957) Jan.

The electrodeposition of Mg from ether solutions of such Mg compounds as (a) halides, (b) aluminohydrides, (c) borohydrides, and (d) Grignard reagents was investigated. White, metallic deposits containing 90% Mg and 10% B were obtained from an ether solution of $MgBr_2$ and $LiBH_4$. However, thick deposits could not be built up. An alloy (7% Mg, 93% Al) was obtained from a bath containing $MgBr_2$, $AlBr_3$, and $LiAlH_4$. Electrodeposited alloys of Zr, Ti, or Be with Mg, obtained from hydride or borohydride baths, were stressed, treed, or powdery. The preparation and solubilities of some of the solutes are given. (auth)

3866

SOLUTION-RATE STUDIES WITH LIQUID METALS: SOLUTION OF COPPER IN LIQUID LEAD AND BISMUTH. A. G. Ward and J. W. Taylor (Atomic Energy Research Establishment, Harwell, Berks). J. Inst. Metals 85, 145-52(1956) Dec.

A study has been made of the kinetics of the dissolution of solid Cu in liquid Pb and Bi under nominally static and isothermal conditions, at temperatures in the range 360 to 510° C. The dissolution followed an expression of the form $n_t = n_0(1-e-[KSt]/V)$, where n_t = concentration of dissolved solute at time t, n_0 = saturation concentration, S = surface area of solid exposed to a liquid of volume V, and K = solution-rate constant. The solution-rate constant in the Bi–Cu system was about three times greater than that for Pb–Cu at any one temperature. The solution-rate constant varied with temperature thus: $K = K_0 e^{-\Delta E/RT}$ where ΔE = the activation energy for the dissolution process. The experimental data appear consistent with dissolution being a complex process involving diffusion of solute through a laminar boundary layer combined with convection effects introduced through density changes accompanying dissolution. From a general relationship between (n_t/n_0) and (t/t_0) it is possible to construct concentration/time relationships, knowing only the saturation concentration and the time to reach saturation. (auth)

3867

THE COLD-ROLLED TEXTURE OF HAFNIUM. D. S. Eppelsheimer and D. S. Gould (Missouri School of Mines and Metallurgy, Rolla, Mo.). J. Inst. Metals 85, 158-60 (1956) Dec.

Arc-melted crystal-bar hafnium containing 3% zirconium was given 95% reduction in thickness by cold rolling to 0·004 in. strip. The preferred orientation of the strip was studied by a Geiger-counter-spectrometer x-ray-diffraction technique. The material showed a (0001) $[10\bar{1}0]$ texture rotated 25° toward the transverse direction about an axis in the rolling direction. (auth)

3868

OPTICAL PROPERTIES AND OXIDATION OF EVAPORATED TITANIUM FILMS. Georg Hass and Alan P. Bradford (Engineer Research and Development Labs., Ft. Belvoir, Va.). J. Opt. Soc. Amer. 47, 125-9(1957) Feb.

Measurements were made of the optical constants and of the reflectance and transmittance of Ti films evaporated onto fused quartz and glass. In order to prepare pure Ti films with normal density, all depositions were carried out at a pressure $p < 5 \times 10^{-6}$ mm Hg and with a deposition rate D > 40 A/sec. The optical constants were determined by Drude's polarimetric method from opaque films at the wavelengths 0.436 μ, 0.546 μ, 0.578 μ, and 0.650 μ. The reflectance values computed from n and k agreed well with the directly measured ones. The reflectance of Ti was measured from 900 A to 10 μ. 100 A to 300 A thick films of Ti were found to have quite uniform transmittance throughout the visible spectrum and can, therefore, be used as neutral density filters. Three optical principles were used to measure the oxidation of Ti in air. At room temperature the rate of oxidation of Ti was found to be almost equal to that of Al (about 35 A of oxide are formed in one month) With increasing temperature, however, the oxidation of Ti increases much more rapidly than that of Al. (auth)

3869

PHASE-DIAGRAM STUDY OF ALLOYS IN THE IRON–CHROMIUM–MOLYBDENUM–NICKEL SYSTEM. C. J. Bechtoldt and H. C. Vacher. J. Research Natl. Bur. Standards 58, 7-19(1957) Jan.

Alloys in the Fe–Cr–Mo–Ni system were examined after quenching from 2,200°, 2,000°, 1,800°, 1,650°, and 1,500° F. Compositional limits of stability of seven phases were summarized in diagrams. Fe_2Mo was found to be a stable phase; and a ternary phase, not previously reported, was identified to have the approximate composition of 4% Cr, 53% Fe, and 43% Mo. (auth)

3870

MAGNETIC STRUCTURES IN COPPER–MANGANESE ALLOYS. David Meneghetti and S. S. Sidhu (Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 130-5(1957) Jan. 1.

A neutron diffraction study of a series of substitutional solid solutions up to 85 atomic percent manganese in copper has shown that at about 13 atomic percent manganese, a broad intensity maximum appears in the region of (100) reflection of the face-centered cubic pattern of copper. A correlation of this maximum with the magnetic attraction of the specimens indicates that it is at least in part due to short-range magnetic order. Its intensity decreases at compositions greater than 50 atomic percent manganese. Above 69 atomic percent manganese an antiferromagnetic structure is observed and is interpreted as due to an antiferromagnetic coupling between manganese atoms as the manganese concentration becomes predominant. (auth)

3871

CHEMICAL INTERACTIONS OF TITANIUM WITH OTHER ELEMENTS. I. I. Kornilov and P. B. Budberg. Uspekhi Khim. 25, 1474-1501(1956) Dec. (In Russian)

Constitution diagrams of binary Ti alloys were reviewed to establish a scientific method of determining the optimum content for titanium alloys. To reveal the true character of various element interactions with Ti, the analysis was carried out by groups of elements according to their position in the Mendeleev periodic system in relation to Ti. (R.V.J.)

3872

ELECTROCONDUCTIVITY OF TITANIUM SLAGS. B. M. Lepinskikh, O. A. Esin, and S. V. Shavrin (Inst. of Metallurgy, Ural Acad. of Science). Zhur. Priklad. Khim. 29, 1813-21(1956) Dec. (In Russian)

Measurements were made of the specific electro-conductivity of $Na_2O–TiO_2$, $FeO–TiO_2$, and $MnO–TiO_2$ with various content of TiO_2 at temperatures up to 1470°C. (R.V.J.)

Refer also to abstracts 3710 and 3928.

PHYSICS

3873 AECU-3292

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

RADIATION PROCESSING ECONOMICS. Frank W. Bradley, William M. Murray, Jr., and David R. Whitehouse. May 13, 1955. 25p. For Carbide and Carbon Chemicals Co. [K-25 Plant.] Contract [W-7405-eng-26, Subcontract 70]. (KT-210). $0.25(OTS).

Beta and gamma radiation, a new unit operation for the processing of commercial products, is considered from both a technical and an economic viewpoint. The effects of irradiation, and the cost, availability, and use of a variety of beta and gamma sources are discussed. (24 references.) (auth)

3874 AECU-3401

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Progress Report No. 2 [for] June 1, 1956 to September 1, 1956. P. D. Coleman, R. Kenyon, H. Mahrous, R. Mieher, M. D. Sirkis, W. Steier, and A. W. Swago. Sept. 15, 1956. 34p. Contract AT(11-1)-392. $6.30(ph OTS); $3.00 (mf OTS).

The design and development of a compact, portable relativistic electron bunching accelerator (rebatron) is discussed. Circuit diagrams are included. Schemes are also discussed for using the bunched electron beam from the rebatron to produce high pulsed power in the 0.1 mm wavelength region of the electromagnetic spectrum. Detector circuits are also given. (B.J.H.)

3875 HW-47063

Hanford Atomic Products Operation, Richland, Wash.

THERMAL CONDUCTIVITY MEASUREMENTS. J. M. Davidson. Dec. 3, 1956. 18p. Contract W-31-109-Eng-52. $0.20(OTS).

Three devices for the room temperature measurement of thermal conductivity are described. They provide fast, reproducible and accurate results on samples whose thermal conductivity is between 0.5 and 0.05 cal/sec/cm/°C. The three devices were designed to handle samples of varied dimensions and conductivities. The Kohlrausch and Mark II methods measure the conductivity of samples whose dimensions are 0.426 in. in diameter × 4 in. The Disk I measures the conductivity of wafer shaped samples 1.25 in. in diameter × 0.10 in. Deviation from these quoted sample sizes are possible. (auth)

3876 OSR-TR-56-56

Stanford Research Inst., Menlo Park, Calif.

STUDY OF THE UTILIZATION OF A SOLAR FURNACE FOR HIGH TEMPERATURE RESEARCH ON SOLIDS. Final Summary Report. (Report No. 9). Thomas E. Tietz and Nevin K. Hiester. Sept. 28, 1956. 10p. SRI Project No. Cu-1410. Contract AF18(600)-1499. (AD-115011).

Summaries of five technical reports are given. (D.E.B.)

3877 AERE-Lib/Trans-635

THE TIME-TEMPERATURE CHARACTERISTIC IN ELECTRIC CONTACTS. M. Kohler and G. Zielasek. Translated by W. Clanville from Abhandl. Braunschweig. Wiss. Ges. 3, (1951). 9p.

Calculations are given of the time-temperature characteristics of electric contacts. (B.J.H.)

3878

SPECIFIC HEATS OF LIQUID METALS AND LIQUID SALTS. T. B. Douglas (National Bureau of Standards, Washington). Trans. Am. Soc. Mech. Eng. 79, 23-8(1957) Jan.

In view of the general use of liquid metals and liquid salts in heat-transfer systems at high temperatures, their specific heats are reviewed. First, the general method of measuring them is described, and the more important sources of error are discussed. Known data are then examined on a volume basis, and two examples are presented which bear on the relation of the specific heats of mixtures to those of their components. It is finally shown that the specific heats of most liquid metals and liquid salts, when converted to an atomic basis, appear to be sufficiently alike to justify an approximate prediction in many cases for which no data exist. (auth)

3879

ON THE THEORY OF CONCENTRATION QUENCHING OF

FLUORESCENCE IN SOLUTIONS. B. Ya. Sveshnikov. Doklady Akad. Nauk S.S.S.R. 111, 78-81(1956) Nov. 1. (In Russian)

3880

RECENT ADVANCES IN SCIENCE, PHYSICS, AND APPLIED MATHEMATICS. Morris H. Shamos and George M. Murphy, ed. New York and London, Interscience Publishers. 384p.

Methods of applied mathematics including numerical, finite differences and random walk are explained and their use in underwater sound detection, shocks, weather prediction and flood control are discussed. Techniques of operations research, developed primarily for military application have only recently been turned to industrial problems for which they offer great promise, are reported. Several phases of atomic and nuclear physics are included and the rapid rise of interest during recent years in the physical properties of solids are reported. (F.S.)

3881

THE ELASTIC AND THERMO-ELASTIC PROPERTIES OF COMPOSITE MEDIA. E. H. Kerner (Univ. of Buffalo, N. Y.). Proc. Phys. Soc. (London) B69, 808-13(1956).

The elastic and thermoelastic properties of grain compacts and grain suspensions are deduced by an averaging procedure. (T.R.H.)

3882

IMPROVED TECHNIQUE FOR THE EVAPORATION OF BORON. George J. Safford (Columbia Univ., New York). Rev. Sci. Instr. 27, 972(1956) Nov.

A resistance heating technique was developed for the evaporation of boron. (B.J.H.)

3883

DIRECT MEASUREMENT OF MONOLAYER ADSORPTION ON A GEIGER-TUBE WINDOW. Hurley D. Cook (Standard Oil Co., Whiting, Ind.). Rev. Sci. Instr. 27, 1081-2(1956) Dec.

3884

EVAPORATION OF BORON. Henry A. Hill (Univ. of Minnesota, Minneapolis). Rev. Sci. Instr. 27, 1086(1956) Dec.

A satisfactory technique for evaporating boron is described. The boron is heated primarily by electron bombardment and secondarily by radiation from the filament emitting the electrons. (B.J.H.)

AEROSOLS

3885 AECU-3200

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

VAPOR TRAPS FOR HANDLING LIQUID SODIUM. A. J. Erickson, C. L. Gregory, and P. M. Lang. Aug. 25, 1951. 11p. For Carbide and Carbon Chemicals Div. [K-25 Plant. Contract W-7405-Eng-26, Subcontract 70]. (KT-109). $3.30(ph OTS); $2.40(mf OTS).

Proposals for removing Na aerosol by an electrostatic precipitator, a copper coil condenser, and a bubbler were tested and evaluated. All were at least partially effective, the condenser proving to be the most practical to operate. (F.S.)

3886 NYO-4611

Harvard Univ., Boston. Air Cleaning Lab.

AIR CLEANING STUDIES. Progress Report for July 1, 1954 to June 30, 1955. Richard Dennis, Leslie Silverman, Charles E. Billings, David M. Anderson, William R. Samples, Harry M. Donaldson, Jr., and Philip Drinker. Oct. 15, 1956. 56p. Contract AT(30-1)-841. $0.40(OTS).

Progress on the air and gas cleaning project conducted by Harvard University for the Engineering Division of the Atomic Energy Commission is reported. Primary objectives of this project include research and development on air and gas cleaning devices and methods for their testing and evaluation, training and education of Commission and contractor personnel, collection and correlation of information on air and gas cleaning techniques, and consultation services. Investigations on the role of electrostatic forces in gas cleaning, studies on resistance and filtration characteristics of fiber media, a study of dust re-entrainment from filters exposed to shock waves, and rating of high efficiency roughing filters were continued. New projects included determination of gas cleaning requirements for a pilot model institutional incinerator, a theoretical study of the behavior of null-type sampling probes, evaluation of miniature cyclones for gas sampling and laboratory testing of a new type wet scrubber and two commercial collectors employing electrified fiber mats. (auth)

ASTROPHYSICS

3887

PHYSICAL CONSTANTS IN EXTRA-GALACTIC NEBULAE. M. P. Savedoff (Univ. of Rochester, N. Y.). Nature 178, 688-9(1956) Sept. 29.

3888

NUCLEAR REACTIONS IN THE LATER STAGE OF THE STELLAR EVOLUTION. Kimiko Nakagawa, Takashi Ohmura, Hisao Takebe, and Shinya Obi (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 16, 389-415(1956) Oct.

Nuclear reactions induced by helium capture, $3\alpha \rightarrow C^{12} + \gamma$ etc., are investigated. The results are applied to the study of the variation of chemical abundances and the energy generation in the hydrogen exhausted stellar core with suitable physical conditions. The reactions $C^{12} + C^{12}$ etc., are also discussed. The results obtained are useful to study the stellar evolution in its later stage. (auth)

3889

HELIUM CAPTURING REACTIONS IN STARS. Satio Hayakawa, Chushiro Hayashi, and Mitsuo Imoto (Kyoto Univ.) and Ken Kikuchi (Osaka Univ.). Progr. Theoret. Phys. (Japan) 16, 507-27(1956) Nov.

The generation of C^{12}, O^{16} and Ne^{20} by successive α-capturing processes in the He core of stars is calculated under the condition at temperature $\sim 10^{8}$°K. The rates of forming C^{12} and Ne^{20} are found to be much larger than the previous calculations by Salpeter, Öpik and Hoyle, due to the resonance levels recently discovered. The production rates of Mg^{24} to Ca^{40} are also estimated. The formation of these nuclei is found to be negligible at temperatures below 4×10^{8}°K. The luminosity of such stars of globular clusters belonging to the horizontal branch in the H–R diagram that are supposed to be burning helium is accounted for in terms of the above thermonuclear reactions at the central temperature of $(1.40 \pm 0.10) \times 10^{8}$°K and the density of about 10^{3} g cm^{-3}. The lifetime of a star in this evolutionary stage is estimated roughly as 10^{7} years. In this course of evolution Ne^{20} is formed more abundant than others, in disagreement with the average cosmic abundances of C^{12}, O^{16} and Ne^{20}. The modification of the abundances after this stage is suggested as necessary. (auth)

COSMIC RADIATION

3890 NP-6189

Washington Univ., St. Louis.

A CLOUD CHAMBER STUDY OF NEUTRON PRODUCTION BY PENETRATING μ MESONS AT SEA LEVEL (thesis). Technical Report No. 21. Brenton Fisk Stearns. Sept. 1956. 107p. Contract N6-ONR-202, T. O. III.

A magnet cloud chamber was used to study neutron production in Pb by penetrating μ mesons at sea level. Complete designs and descriptions of the equipment are included. A complete analysis of the data is presented. The results show that single penetrating μ mesons of mean momentum 2.3 Bev/c produce neutrons in Pb with a cross section multiplicity of $(22 \pm 8) \times 10^{-29}$ cm^2/nucleon. Agreement with theory is good. (B.J.H.)

3891

ON THE PHASE AND THE AMPLITUDE OF COSMIC RAY DIURNAL VARIATION. Bengt Stensland. Arkiv Fysik 11, 253-8(1956).

The diurnal variation in cosmic ray intensity has been measured at the geophysical station in Kiruna with a Geiger-Mueller counter set comprising three counter-telescopes, one pointing to the zenith and two pointing east and west respectively with zenith angles of 30°. It appears that the phase and amplitude of cosmic ray intensity variation has varied during the period January 1, 1954 to March 23, 1955. The registrations also indicate that the average momentum of cosmic rays is about 3×10^{10} ev/c[4]. The original direction of cosmic rays before being deflected in the magnetic field of the Earth has been constructed for the three directions zenith, west and east, keeping in mind the fact that the momentum varies. (auth)

3892

INVESTIGATIONS OF NUCLEAR-ACTIVE COMPONENTS OF EXTENSIVE ATMOSPHERIC SHOWERS IN COSMIC RADIATION. S. I. Nikol'skii, Yu. N. Vavilov, and V. V. Batov (Lebedev Inst. of Physics). Doklady Akad. Nauk 111, 71-3(1956) Nov. 1. (In Russian)

Experiments were made to determine the spatial distribution and the number of nuclear-active particles with the energy of $\geq 10^{-9}$ ev. The measurements were taken at 3860m above sea level (Pamir) in the summer and autumn of 1954. The total number of charged particles in each recorded shower was calculated (with the relative error of $\leq 10\%$) by measuring the stream density of shower particles at various distances from the shower axis. The possibility of formation and the recording of δ showers induced by nuclear-passive particles (μ-meson) were also determined in the same experiments. All showers recorded during the period of observation were divided into groups according to the total number of particles. The functions of spatial distribution of nuclear-active particles for each group were analyzed in the intervals from 1 to 40 m from the axis of the showers. (R.V.J.)

3893

SOLAR INFLUENCES ON COSMIC RAYS. Scott E. Forbush (Carnegie Inst. of Washington, D. C.). Proc. Natl. Acad. Sci. U. S. 43, 28-41(1957) Jan.

Data obtained over a period of 20 years with ionization chambers are summarized. Solar flare effects, magnetic storm effects, and cosmic ray intensity variation with sunspot cycles are discussed. (B.J.H.)

3894

SOLAR ORIGIN OF CHANGES IN THE PRIMARY COSMIC RADIATION. J. A. Simpson (Univ. of Chicago, Ill.). Proc. Natl. Acad. Sci. U. S. 43, 42-56(1957) Jan.

The observed nonperiodic changes of primary cosmic-ray intensity within the solar system are either the result of occasional, de novo production in the region of the sun or the modulation of pre-existent radiation from outside the solar system. As shown earlier, these variations represent changes in the primary spectrum over a wide range of particle energies involving over 95 per cent of all the cosmic radiation. Since the modulation mechanism which produces these spectrum changes has its origin in solar activity, it is clear that only during periods of extreme minimum solar activity will it be able to record briefly the galactic spectrum at the earth. In summary, it is likely that further studies of cosmic-ray intensity variations may extend knowledge of the electrodynamics of the solar system and the nature of geomagnetic storms in particular, place upper limits on the production of cosmic rays at the sun, and enable us to gain further information on the galactic spectrum. (auth)

3895

DIRECT DETECTION OF AURORAL RADIATION WITH ROCKET EQUIPMENT. James A. Van Allen (State Univ. of Iowa, Iowa City). Proc. Natl. Acad. Sci. U. S. 43, 57-62(1957) Jan.

Observations were made of the cosmic radiation above the atmosphere using Geiger tubes or scintillation spectrometers carried within the thin-walled nose shell of a small rocket. Typical sets of data are shown. Interpretation of the data is briefly summarized. (B.J.H.)

3896

ON THE ENERGY DEPENDENCE OF THE CROSS SECTION FOR THE PRODUCTION OF THE PENETRATING SHOWER UNDERGROUND. S. Higashi, M. Oda, T. Oshio, H. Shibata, K. Watanbe, and Y. Watase (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 16, 250-1(1956) Sept.

3897

IONIZATION SPECTRUM OF THE COSMIC RAY SOFT COMPONENT AT SEA LEVEL. A. G. Meshkovskii and L. I. Sokolov. Soviet Phys. JETP 3, 683-91(1956) Dec.

A new method for the investigation of ionization spectra of cosmic ray particles is worked out. Ionization spectra are taken for particles with penetration in the intervals 2 to 3, 3 to 5, 5 to 9, and 9 to 15 cm of lead. Conclusions are reached about the distribution of the proton component at sea level among these penetration intervals. (auth)

3898

ENERGY SPECTRUM OF π^--MESONS PRODUCED BY COSMIC RAYS IN PHOTOGRAPHIC EMULSIONS. A. A. Varfolomeev, R. I. Gerasimova, E. A. Zamchalova, M. I. Podgoretskii, and M. N. Shcherbakova (Academy of Sciences, USSR). Soviet Phys. JETP 3, 986-8(1957) Jan.

Two piles of emulsion stacks were irradiated in the stratosphere so that the mean direction of the primary cosmic particles was in the plane of the emulsion. About 1000 tracks of stopped π mesons were traced of which 195 π^+ and 328 π^- mesons were formed in the emulsions. The energy spectrum of the π^- mesons is shown. (B.J.H.)

ELECTRICAL DISCHARGE

3899

EXPERIMENTAL INVESTIGATIONS OF THE MOTION OF PLASMA PROJECTED FROM A BUTTON SOURCE ACROSS MAGNETIC FIELDS. E. G. Harris, R. B. Theus, and W. H. Bostick (Univ. of California Radiation Lab., Livermore). Phys. Rev. 105, 46-50(1957) Jan. 1.

The velocity with which the plasma from a button source propagates across magnetic fields has been measured as a function of the experimental parameters. These experiments revealed that the velocity of the plasma front is a slowly varying function of the magnetic field strength from one to six kilogauss and increases monotonically with the voltage applied to the source condensers. Measurements of the arrival time of the plasma front versus distance from the source show that it moves across the magnetic field with constant velocity. When the source orientation is such that the force exerted by the magnetic field on the discharge current is in the direction of propagation the velocity is increased, and vice versa. (auth)

3900
THEORY OF WAVE MOTION OF AN ELECTRON PLASMA. A. I. Akhiezer and R. V. Polovin (Physico-Technical Institute, Academy of Sciences, Ukrainian SSR Kharkov State Univ.). Soviet Phys. JETP 3, 696-705(1956) Dec.

A general investigation of the nonlinear wave motions of an electron plasma has been carried out for arbitrary electron velocities. Temperature effects are not taken into account, and the state of the plasma is characterized not by a distribution function, but by the particle density. A correspondence is established between the wave motion of the plasma and the motion of a nonrelativistic particle in a certain potential field. The variation of the frequency of longitudinal vibrations on the velocity amplitude has been determined. Nonlinear transverse vibrations of the plasma and vibrations close to these, are also considered, and their frequencies determined. A number of relations are established for the complicated longitudinal transverse plasma oscillations. (auth)

ELECTRONS

3901
SCATTERING OF ELECTRONS IN A LIQUID DUE TO VIOLATION OF LONG RANGE ORDER. A. I. Gubanov (Academy of Sciences, USSR). Soviet Phys. JETP 3, 854-61(1957) Jan.

Further development of the zone theory of liquids is given by the investigation of the motion of electrons in a liquid in terms of Cartesian coordinates. The assumed zero approximation wave functions are similar to the Bloch functions for crystals and satisfy equations which differ from the Schrödinger equation by small terms. Scattering of the electrons in a liquid due to violation of long range order in the atomic arrangement has been calculated and the dependence of the corresponding electron mean free path on wave number has been determined for small values of the wave number. (auth)

GASES

3902
PROBLEMS OF STRONG EXPLOSIONS APPROACHING TO SPHERICAL. E. I. Andriankin (Inst. of Chemical Physics). Doklady Akad. Nauk S.S.S.R. 111, 554-6(1956) Nov. 21. (In Russian)

A case in which the shape of the wave differs slightly from the sphere and the gas motion, which was taken as adiabatic with constant ratio of heat capacity ($C_p/C_v = \gamma$) is approaching the automodel one, was analyzed. (R.V.J.)

3903
APPROXIMATION FORMULAS FOR CALCULATIONS OF FRONTAL CHARACTERISTICS OF SHOCK WAVE IN POINT-SOURCE BLAST IN GAS. V. P. Korobeĭnikov (Steklov Inst. of Mathematics). Doklady Akad. Nauk S.S.S.R. 111, 557-9 (1956) Nov. 21. (In Russian)

Simple approximation formulas are shown for calculations of shock wave front parameters for any γ, for the cases of spherical, cylindrical or plane flat waves. (R.V.J.)

INSTRUMENTS

3904 AD-76044
Ohio State Univ. Research Foundation, Columbus.
CONDUCTION AND RADIATION COOLING OF ELECTRONIC UNITS WITH COOLING PLATES. Report No. 46. Walter Robinson, C. D. Jones, and C. F. Sepsy. Aug. 1955. 87p. Contract W33-038ac-14987.

A study was made of the application of conduction and radiation cooling of electronic components in a power supply test unit. The performance of an air-cooled plate with conduction shields and of an evaporator plate was studied in conjunction with and without the test unit. (auth)

3905 AERE-C/M-185
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A PEN RECORDING POLAROGRAPH FOR ANALYTICAL APPLICATIONS. R. N. Whittem and G. W. C. Milner. Sept. 3, 1953. 8p.

Details are given of an automatic pen recording polarograph which incorporates a Brown Electronik Potentiometer for recording the current-voltage curves. This instrument contains all the refinements of commercially available polarographs with the exception of the condenser current control. From polarographic steps recorded with this instrument, it appears that the precision of measurement of diffusion currents is limited by irregularities in the electrode system rather than by instrumental errors. (auth)

3906 AERE-CE/R-820
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
LIQUID METAL BRUSHES. D. A. Watt. Nov. 30, 1951. Decl. Jan. 12, 1956. 41p.

Experiments to assess the mechanical properties of liquid metal brushes for a high current, low voltage generator are described. The torque-speed laws for channels of rectangular and semi-circular section using mercury and water are derived. The results lead to specific recommendations for channel sections to secure minimum friction losses and satisfactory running conditions. (auth)

3907 AERE-EL/M-73
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE STABILITY OF LOW CURRENT SELENIUM RECTIFIERS IN E.H.T. CIRCUITS. C. Sharpe. July 10, 1952. 12p.

A study was made to determine the suitability, of K3 type Se rectifiers for use in circuits requiring a high degree of stability. The measurements were made by comparison with a thermionic diode in a bridge circuit. The results indicate that these rectifiers should not be used where a high degree of precision is required. (B.J.H.)

3908 AERE-Inf/Bib-53
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
BIBLIOGRAPHY ON REMOTE CONTROL. Nov. 8, 1949. Decl. Nov. 1, 1956. 10p.

3909 HW-37077
Hanford Atomic Products Operation, Richland, Wash.
METALLURGICAL EXAMINATION OF RESISTANCE THERMOMETER ELEMENTS REMOVED FROM 105 KW AND KE AREAS. L. A. Hartcorn. June 6, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

An examination was made of the resistance thermometer units which were removed from the KW and KE reactors. The examination was made in order to determine the extent of corrosion between the silver brazing alloy and the stainless steel nut and to establish that metallurgical defects exist in the brazes. Most of the elements from the KW reactor showed evidence of corrosion attack. The KE units had been installed with a rubber washer placed over the braze. Some of these units were corroded, but to a lesser degree than the KW units. (B.J.H.)

3910 IDO-16306

Phillips Petroleum Co. Atomic Energy Div. Idaho Falls, Idaho

INVESTIGATION OF THE OVERLOAD CHARACTERISTICS OF THE NORWOOD CONTROLS TRANSDUCER AND MONITOR AMPLIFIER. T. J. Boland and G. L. Smith. Mar. 15, 1955. Changed from OFFICIAL USE ONLY Aug. 16, 1956. 8p. Contract AT(10-1)-205. (PPC-103). $1.80(ph OTS); $1.80(mf OTS).

Results of the MTR Al–H_2O reaction experiment indicated that pressures were developed which were much greater than the calculated expected pressures. In order to provide a basis for interpreting the results, gun powder and electrical signal experiments were conducted to study the overload characteristics of the pressure monitoring equipment which consists of a strain-gage pressure transducer with monitor amplifier, an oscilloscope, a function generator, and a high-speed camera. (B.J.H.)

3911 NAVORD-3461

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

TWELVE GUIDES TO RELIABLE ELECTRONIC DESIGN. Period Covered: February to August 1953. Gordon G. Johnson. Apr. 18, 1955. 58p. Projects 701 and TP-872-J. (NOTS-1064).

This report is based primarily on an extensive literature survey. Reliability topics discussed include the effects of increased equipment complexity, distribution of causes of equipment failure, techniques of reliable design, and selection of components. Vacuum tubes, resistors, and capacitors are the only components discussed at any length. Resistors and capacitors are considered from the viewpoint of comparative specifications rather than experimentally determined reliability. Tube-reliability factors briefly covered are: filament current surges, cathode-interface formation, tube envelope temperatures, new cathode designs, and the use of special tubes (RCA "Special Red" series, RCA computer series, ruggedized, and G.E. five-star ARINC series). Also given is a bibliography of 89 of the better articles reviewed. (auth)

3912 UCRL-3597

California. Univ., Berkeley. Radiation Lab.

THE CONSTRUCTION OF PULSE-GUIDE COAXIAL TRANSMISSION LINES. C. Norman Winningstad. Nov. 7, 1956. 13p. Contract W-7405-eng-48. $0.20(OTS).

A detailed method of fabrication is given for the construction of a low-loss, rigid, 125-ohm coaxial line for the transmission of millimicrosecond (mμsec) pulses. The characteristic impedance can be made uniform by use of this construction method, and can be predicted to about 1% by utilization of the charts relating dielectric density, dielectric constant, and diameter ratio to characteristic impedance. A method is given for the correction of discontinuities associated with corners and dimensional transition sections. This method reduces reflections from corners or transition sections, when observed with an oscilloscope of 1-mμsec rise time, to 1% or less. The cost figures are given for six 150-mμsec single transit-time lines. (auth)

3913 WAPD-EM-169

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

LARGE MODEL TEST PUMP—HISTORY AND TEST DATA. J. D. Walls. Mar. 10, 1952. Changed from OFFICIAL USE ONLY Oct. 1, 1956. 40p. Contract [AT-11-1-GEN-15]. $6.30(ph OTS); $3.00(mf OTS).

The test history of the large model test pump is summarized. Complete results are included. (See also WAPD-EM-56.) (B.J.H.)

3914 AEC-tr-2704

TESTING OF THERMOELEMENTS. Lindbeck and Rothe. Translated by K. S. Bevis from Z. Instrumentenk. 20, 290-9(1900). 10p.

The design and characteristics of a compensating circuit which allows very accurate calibration of emf and resistance thermometers are presented. (D.E.B.)

3915

SEMI-AUTOMATIC ARC GAP WITH A MOTORIZED STAND. Louis E. Owen (Goodyear Atomic Corp., Portsmouth, Ohio). Appl. Spectroscopy 10, 203-6(1956).

A system providing semiautomatic arc-gap control for emission spectrography is described. Motor-driven electrode-carrying arms of an arc-spark stand are positioned according to signals derived from phototransistors located in the image plane of the arc gap produced by a cylindrical lens. The circuitry is applicable to other stands. (auth)

3916

HIGH OUTPUT MULTIPLIER TUBES WITH ACCELERATOR GRIDS. J. S. Allen and L. R. Megill (Los Alamos Scientific Lab., N. Mex.). IRE Trans. Nuclear Sci. NS-3, No. 4, 112-14(1956) Nov.

A multiplier tube capable of producing output currents greater than one ampere has been constructed. In order to produce high electrical fields at the surfaces of the dynodes a design utilizing an accelerating grid near the surface of each dynode was chosen. A space charge limited current of 1.2 to 1.3 amperes was obtained using 400 volts between each dynode and accelerating grid. (auth)

3917

EDGE EFFECTS IN ELECTROMAGNETIC FLOWMETERS. J. A. Shercliff (Cambridge Univ.). J. Nuclear Energy 3, 305-11(1956) Nov.

A simplified, approximate analysis is made of the effects of the currents which circulate in the moving fluid at the edges of the transverse magnetic field of a flowmeter. These effects include a loss of sensitivity, a deformation of the magnetic field, a distortion of the velocity profile, an additional pressure loss across the flowmeter and a corresponding force on the magnet poles. (auth)

3918

EVAPORATION DEVICE FOR BETA-SPECTROMETER SAMPLES. R. Stockendal and K. E. Bergkvist (Nobel Inst. of Physics, Stockholm 50, Sweden). Nuclear Instr. 1, 53-4(1957) Jan.

Evaporation crucibles for obtaining radioactive samples with the activity concentrated on a small area were constructed. These crucibles are made of platinum and soldered with a platinum hard-solder and can stand a temperature of 1600°C. The dimensions are such that the highest temperature is in the middle part of the device during the evaporation. (F.S.)

3919

DATA-HANDLING SYSTEM FOR NUCLEAR-POWER TESTS. Raymond A. Edwards (General Electric Co., San Jose, Calif.). Nucleonics 15, No. 2, 53-7(1957) Feb.

The application of electronic data reducing devices to collect, record, and store data from nuclear power test stations is discussed. A design for this application is described and its capabilities and cost discussed. (T.R.H.)

3920

AN F-M MULTICHANNEL PULSE-HEIGHT ANALYZER. J. T. Russell and H. W. Lefevre (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 15, No. 2, 76,78-9 (1957) Feb.

A design is offered which appears to be an advance in the direction of overall channel stability. The high speed potential, although unproved, may be of use as an analyzer in connection with a pulsed accelerator. (auth)

3921

AUTOMATIC TIMER SIMPLIFIES SMALL-CURRENT MEASUREMENTS. L. Costrell and F. H. Attix (National Bureau of Standards, Washington). Nucleonics 15, No. 2, 83-4(1957) Feb.

3922

A PHOTON MONOCHROMATOR FOR BETATRON BREMSSTRAHLUNG RADIATION. J. Goldemberg. Rev. Mex. Fis. 5, 135-52(1956) July. (In Spanish)

A new instrument was developed in order to sort out monochromatic x rays of high energy from the continuous bremsstrahlung spectrum of a 22-Mev betatron. The resolution of the instrument was of the order of 2%. Measurements were made of total electronic absorption coefficient in carbon in the energy interval 14.5 to 16.5 Mev. A good agreement with theory was obtained. (auth

3923

CONTROLLED CAPILLARY GAS LEAK. R. K. Smither (Yale Univ., New Haven Conn.). Rev. Sci. Instr. 27, 964-5 (1956) Nov.

A relatively simple adjustable capillary leak is described in which the gas flow is controlled by regulating the temperature of the gas in the capillary. This capillary leak contains no moving parts and can be controlled from a distance. The actual controlled flow is compared with the theoretical predictions, and a calibration curve is shown. (auth)

3924

COLD TRAP ANTI-ICING SHIELD. Harry J. Svec (Iowa State Coll., Ames). Rev. Sci. Instr. 27, 969-70(1956) Nov.

3925

THREE DIRECTIONAL MOTION VACUUM SEALED JOINT. H. Smotrich and L. Feldman (Columbia Univ., New York). Rev. Sci. Instr. 27, 970(1956) Nov.

Design details are given for a vacuum sealed joint with motion in the 3 directions of a cylindrical coordinate system. It was developed to make possible the remote positioning of a cyclotron arc source. (B.J.H.)

3926

MAGNETIC RECORDER FOR NUCLEAR PULSES. P. E. Cavanagh and D. A. Boyce (Atomic Energy Research Establishment, Harwell, Berkshire, Eng.). Rev. Sci. Instr. 27, 1028-33(1956) Dec.

A simple reliable process is described for recording the amplitudes of individual pulses on magnetic tape. This enables the pulse analysis to be performed after the experiment, and under optimum conditions. Low counting rates may be recorded with the tape moving slowly, and then speeded up on playback, so that, for example, a twenty-four hour run may occupy only seven minutes analyzer time. The recording process is strictly linear over a range of signal/rms noise of up to 300/1. A maximum rate of 4000 pps may be recorded. The resolution varies with pulse amplitude, but, over the upper two-thirds of the linear range the relative spread assumes a very nearly constant value of about 3%. A further development is described in which gated time coincident pulses are recorded simultaneously on twin tracks of the same tape. In data gathering power this system is better than an array of thirty conventional thirty channel pulse analyzers. It may also be applied to the simultaneous recording for separate analysis of the outputs of up to about ten independent detectors. (auth)

3927

CRYOSTAT FOR SPECTROPHOTOMETRIC MEASUREMENTS. Thomas O. Jones and John E. Willard (Univ. of Wisconsin, Madison). Rev. Sci. Instr. 27, 1037-9(1956) Dec.

A cryostat is described which will maintain optical cells at any temperature from −190 to 0°C while they are being scanned in a recording spectrophotometer. Liquid air is used as the refrigerant and the temperature is adjusted by means of an electrical resistance heater. Fogging of the optical system is avoided by circulation of the dry refrigerant vapors and by window heaters. (auth)

3928

CONSTANT STRESS CREEP APPARATUS. Raymond C. Boettner and W. D. Robertson (Yale Univ., New Haven, Conn.). Rev. Sci. Instr. 27, 1039-40(1956) Dec.

A simple creep apparatus for approximating a constant stress in tensile specimens of large cross sections, where large applied loads are required, is described. The apparatus consists of a lever with a large built-in mechanical advantage, together with means for removal of incremental weights from the applied load. (auth)

3929

SLIDE RULE FOR RADIOGRAPHIC ANALYSIS. Bruno Lundburg and Burton L. Henke (Karolinska Institutet, Stockholm). Rev. Sci. Instr. 27, 1043-5(1956) Dec.

A simple slide rule has been developed which will permit a rapid and accurate determination of radiographic sample transmission, of absorption index, μm, and of the photographic film density corresponding to the direct x-ray beam by means of a single setting of the sliding scale. (auth)

3930

DEKATRON DRIVE CIRCUIT AND APPLICATION. M. Graham, W. A. Higinbotham, and S. Rankowitz (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 27, 1059-61 (1956) Dec.

A reliable, one-tube drive circuit for decade glow transfer counter tubes is described. Application of the circuit is illustrated in a ten-channel glow tube register with automatic electric typewriter readout. (auth)

3931

IMPROVED METAL GASKET FOR VACUM SYSTEMS. Joseph B. Mann (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 27, 1083-4(1956) Dec.

3932

ON SOME PROBLEMS OF MACHINE TRANSLATIONS. I. K. Bel'skaya, L. N. Korolev, et al. Vestnik Akad. Nauk S.S.S.R. 26, 24-33(1956) Dec. (In Russian)

A general scheme of machine translation from English to Russian and from one foreign language to another with Russian as the intermediary is discussed. (R.V.J.)

ISOTOPES

3933 CF-54-11-12

Oak Ridge National Lab., Tenn.

PREPARATION OF IRON-55 SOURCES. R. E. McHenry. Dec. 29, 1954. 5p. Contract W-7405-eng-26. $1.80 (ph OTS); $1.80(mf OTS).

A procedure is described for the preparation of Fe^{55} sources which do not require any cover, do not smear, and have low self-absorption. (auth)

3934 CF-55-9-1

Oak Ridge National Lab., Tenn.

DETERMINATION OF RESIDUAL ACTIVITIES FROM LONG-LIVED FISSION PRODUCTS OF U^{235}. E. J. Frederick. Sept. 13, 1955. Changed from OFFICIAL USE ONLY Dec. 20, 1956. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A table of nuclear constants and saturation values for a thermal-neutron flux of 2×10^{13} n/cm^2/sec or a power density of approximately 1 kw/g of initial U^{235} charged

to the reactor is presented for all of the U^{235} fission products with half lives greater than 8 days but less than 100 years and fission yields greater than 0.01%. Approach-to-saturation and decay of activity vs. time are plotted in a series of graphs for all the fission products included in the table. Several examples of practical application of these data are included. (auth)

3935 ORNL-2236
Oak Ridge National Lab.
STABLE ISOTOPES DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING NOVEMBER 30, 1956. Feb. 12, 1957. 63p. Contract W-7405-eng-26. $0.40 (OTS).

Work is reported in the separation and purification of stable isotopes, rare-earth chemistry, mass spectrometry and related techniques, and spectroscopy research. (For preceding period see ORNL-2114.) (T.R.H.)

3936
ENRICHMENT OF THE RADIOACTIVE ISOTOPES OF IODINE, GERMANIUM, ARSENIC, AND ANTIMONY OBTAINED BY THE (γ,n) REACTION. A. N. Murin, V. D. Nefedov, V. I. Baranovskiĭ, and D. K. Popov (Zhdanov Leningrad State Univ.). Doklady Akad. Nauk S.S.S.R. 111, 806-17(1956) Dec. 1. (In Russian)

Results are reported of experiments made to enrich the radioactive isotopes obtained by the γ quanta bombardment of elements in a synchrotron. The bombardment was carried out for 48 hr by bremsstrahlung radiation on a synchrotron with maximum γ quanta equal to 265 Mev. Special monitoring experiments revealed complete absence of neutron background in the beam. The chemical procedures, and the enrichment and yield factors are presented in a tabulated form. (R.V.J.)

3937
EVIDENCE FOR A LIGHT ISOTOPE OF RUBIDIUM. R. Chaminade, M. Cros, I. Gratot, and M. Le Pape. Nuclear Phys. 2, 634-9(1957) Jan. (In French)

It is shown that the reactions Cu + O, Cu + Ne, Ga + N lead to the formation of a new isotope of Rb, a β^+ emitter of period 24 ± 1 min. emitting a complex γ radiation of about 150 kev; its mass number is probably 79. (auth)

3938
THE TWO ANTIMONY ISOMERS WITH MASS WEIGHT 128. I. Franz, J. Rodriguez, and R. Radicella. Z. Naturforsch. 11a, 1037-8(1956) Dec. (In German)

3939
A NEW ANTIMONY ISOTOPE Sb^{126}. I. Fränz, R. Radicella, and J. Rodriguez. Z. Naturforsch. 11a, 1038(1956) Dec. (In German)

ISOTOPE SEPARATION

3940 NP-6182
Amsterdam. Universiteit.
THE ENRICHMENT OF RADIOACTIVE ISOTOPES BY THERMAL DIFFUSION (thesis). Adolf Eduard de Vries. [Sept. 19, 1956]. 87p.

The thermal diffusion column of Clusius and Dickel is a very suitable apparatus to enrich isotopes with on a laboratory scale. It is suggested that the enrichment of isotopes, present on a very small scale (as for instance radioactive isotopes generally are), can be increased by the addition of a third gas. A survey is given of the most important features and applications of the thermal diffusion column. The phenomena for three isotopes are discussed. The most important points emphasized are as follows. In the case of a quantitative separation of two or more sufficiently abundant isotopes use of another gas is made. This gas must concentrate in the column between the two isotopes. It is of no importance whether this gas causes a change in the separation factor (separation between top and bottom of the column). If a decrease should occur a longer column must be taken. For the enrichment of a low-abundant isotope other factors are present. The enrichment cannot be increased arbitrarily by using a longer column but it approaches a limiting value. The enrichment may be improved by the addition of a gas. This gas need not concentrate between the isotopes. But it should not cause an appreciable change in the separation factor. According to the theory, the separation factor between two isotopes hardly decreases by the addition of another gas if its mass is not too different from that of the isotopes. For instance the addition of a gas with mass 35 to a mixture of isotopes with masses 28 and 30 causes a decrease in separation factor of less than 1%. Because the theory only applies to isotopes, experiments have to be made to verify the validity of point 3 in the case of non-isotopic mixtures. Descriptions are given of the experiments made to compare theory and practice. These experiments were carried out with CO in which $C^{14}O$ had to be enriched. Nitrogen, ethene and ethane were the added gases. The conclusion is drawn that nitrogen behaves according to the theory within the experimental error. Also because of its stability this gas is the most suitable. An experiment is carried out to show the usefulness in a column of 10 m. In the case without nitrogen an enrichment of 6 was found while with added nitrogen an enrichment was found of 13. Also the enrichment with and without ethene are compared. Although this gas also may increase the enrichment in some cases a decrease in separation factor occurs. The same applies to ethane. A possible explanation for this decrease is given. Finally, the ways to determine the enrichment in the case of samples with a very low activity are discussed. (auth)

3941
PHOTOCHEMICAL SEPARATION OF MERCURY ISOTOPES. I. A STUDY OF THE EMISSION AND ABSORPTION HYPERFINE LINES OF MERCURY AT 2537 A. K. R. Osborn, C. C. McDonald, and H. E. Gunning (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 26, 124-33(1957) Jan.

An experimental and theoretical investigation has been made of the emission and absorption parameters in the excitation of Hg^{202} atoms in natural mercury to the $6(^3P_1)$ state by irradiation with the resonance line from an electrodeless discharge containing Hg^{202}. The absorption has been studied as a function of absorption path length, the concentration of mercury in the absorption cell, the pressure of certain foreign gases in the absorption cell, the operating temperature of the lamp, and the type of excitor used with the lamp. During the investigation the cross sections for Lorentz broadening of H_2, CH_3Cl and C_3H_7Cl were determined with respect to the Hg^{202} absorption line. The values found were respectively 53.1, 192, and 297×10^{-16} cm^2. (auth)

3942
PREPARATION OF PURE MERCURY ISOTOPES FROM NATURAL MERCURY BY MERCURY PHOTOSENSITIZATION. R. Pertel and H. E. Gunning (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 26, 219(1957) Jan.

MASS SPECTROGRAPHY

3943
HIGH SENSITIVITY MASS SPECTROMETER FOR NOBLE GAS ANALYSIS. John H. Reynolds (Univ. of California, Berkeley). Rev. Sci. Instr. 27, 928-34(1956) Nov.

A high-sensitivity mass spectrometer for noble gas analysis is described in detail. Ultra high vacuum tech-

niques have been used throughout so that small rare gas samples can be closed off within the spectrometer envelope and analyzed statically. This procedure is of considerable advantage in analysis argon and lighter rare gases. The background spectrum when the spectrometer pressure is 5×10^{10} mm Hg is described. Sensitivity data are presented. The detectability of the instrument for xenon atoms (any isotope) is 0.5×10^6 atoms; for A^{36}, the detectability is 14×10^6 atoms. (auth)

MATHEMATICS

3944 LA-2083

Los Alamos Scientific Lab., N. Mex.

MANIAC II. R. B. Lazarus, N. Metropolis, W. Orvedahl, J. H. Richardson, W. Spack, Jr., R. L. Bivins, J. V. Caulfield, I. Kral, A. F. Malmberg, G. T. McKinley, and R. E. Williamson. Oct. 1, 1956. 54p. Contract W-7405-Eng-36. $0.35(OTS).

Maniac II is an improvement over the original Maniac computer by a factor of about five in basic speed and ten in size of internal memory. Design features are described. (C.H.)

3945 WAPD-TM-26

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

COFIT—A LEAST SQUARES COSINE FITTING PROGRAM FOR THE IBM-704. Betty L. Anderson and Thomas J. Lawton. Oct. 1956. 17p. Contract AT-11-1-GEN-14. $0.20(OTS).

The Cofit Code fits, by a least squares technique, the curve $y = A \cos B(X-C)$ to from 4 to 500 points of observed data, computing the parameters A, B, C, and the standard deviations of the estimates of A, B, C—S_A, S_B, S_C. It is also possible to investigate the error in a region about the final values of A, B, C, by computing the sums of the squares of the residuals at a series of points in this neighborhood. Typical computing and editing time for a 30 point problem is 3 minutes, for a 500 point problem, 8 minutes. Any size 704 is adequate, and drums and tapes are not used. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

3946 AECU-3249

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

THE ESTIMATION OF RADIATION DOSES FROM INDIUM FOIL ACTIVITY. J. C. Bailey and H. F. Henry. June 30, 1955. 5p. Contract [W-7405-eng-26]. (KS-499). $1.80(ph OTS); $1.80(mf OTS).

An estimation of the radiation dose from indium foil included in the K-25 security badge for measuring radiation exposures in the event of an inadvertent critical reaction is explained. The estimates are based on β activity induced in the foils by neutrons and are made with GM type β-γ survey meters. (F.S.)

3947 AECU-3393

Sandia Corp., Albuquerque, N. Mex.

AN AUDIBLE RADIATION DOSIMETER. Osborne Milton. May 7, 1956. 18p. (TM-93-56-16). $3.30(ph OTS); $2.40(mf OTS).

An instrument is described which integrates γ radiation flux and sounds an audible warning when a preset dose has accumulated. (auth)

3948 AERE-EL/M-45

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

BORON COATED THERMOPILES. [PART] I. T. A. J. Jaques. Aug. 1950. Decl. Dec. 20, 1956. 6p.

The construction and preliminary operating characteristics of a thermocouple system for measurement of neutron flux are described. (auth)

3949 AERE-EL/M-46

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

BORON COATED THERMOPILES. [PART] II. T. A. J. Jaques. Sept. 1950. Decl. Dec. 20, 1956. 3p.

Experiments to determine the effects of different boron thickness on the output and time constant of a neutron thermometer system are described. (auth)

3950 BNL-425

Brookhaven National Lab., Upton, N. Y.

THE DESIGN AND CALIBRATION OF THE INSTRUMENT TUNNEL FOR IRRADIATIONS OF BIOLOGICAL MATERIAL. H. J. Curtis and N. Delihas. Dec. 1956. 9p. $0.15(OTS).

A neutron irradiation facility designed for biological use has been constructed in a tunnel beneath the Brookhaven reactor. The exposure cavity is approximately 18 by 7 by 6 inches. The neutron flux is a mixture of thermal and fast neutrons, the predominant biological effect being due to thermal neutrons. The gamma-ray flux is very small from a biological point of view. (auth)

3951 CU-155

Columbia Univ., New York. Pupin Cyclotron Lab., and Columbia Univ., New York. Pegram Lab.

HIGH INTENSITY HIGH RESOLUTION SLOW NEUTRON VELOCITY SPECTROMETER (thesis). George W. Grimm. Dec. 15, 1956. 73p. Contract AT-30-1-GEN-72. $12.30 (ph OTS); $4.50(mf OTS).

The slow neutron time of flight spectrometer system which has been developed to utilize the unusual effectiveness of the Nevis Synchrocyclotron for such work is described. A pulsed vertical electrostatic deflector causes the entire circulating proton "group" in the cyclotron to strike a tungsten target during a < 0.1 μ sec interval at the normal 60 c.p.s. repetition rate of the cyclotron. This produces $\sim 10^{17}$ to 10^{18} evaporation neutrons/sec from the tungsten (instantaneous intensity), some of which are moderated in a nylon moderator slab to give an unusually intense pulsed slow neutron source. A 35.22 meter flight path is used and the detector pulses are simultaneously sorted into 128 detection intervals each of 0.25 μ sec or larger to give ~ 0.01 μ sec/meter resolution at ~ 200 ev. A foil of the element being studied is placed at the detector position and the capture gamma rays are detected using large scintillation detectors. A similar foil can also be alternated in and out at a transmission position to give "self indication" transmission measurements. Methods of analyzing the data are given in detail. Twenty one curves are presented showing the results of measurements for Ag and Ta. A detailed analysis is given for a number of levels for each element. The results are compared with the results of lower resolution measurements of other investigators. Tables of values of E_0, $\sigma_0\Gamma$, and $4g\Gamma n^0$ are given for all levels for which analyses were made. (auth)

3952 HW-29282

[Hanford Atomic Products Operation], Richland, Wash.

AN IONIZATION CHAMBER METHOD FOR THE STANDARDIZATION OF TRITIATED WATER SAMPLES. I. T. Myers. July 23, 1953. Decl. Jan. 23, 1957. 20p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Ionization measurements of water vapor in vapor-liquid equilibrium were made with a series of chambers on a tritiated water sample which was prepared by burning T_2 to T_2O and diluting it with H_2O. A correction was made for the difference of vapor pressures of HTO and H_2O. The effect of HTO adsorbed on chamber walls and electrodes was

eliminated from the final result. Using Gerbes' data on the number of electron volts to produce an ion pair in air, agreement was obtained between the measured source strength and the source strength as computed from pressure, temperature, volume, purity, and dilution data on the original gaseous T_2 sample. (20 references.) (C.H.)

3953 HW-38495
[Hanford Atomic Products Operation, Richland, Wash.]
A HIGH RANGE BETA-GAMMA SURVEY INSTRUMENT. W. G. Spear. July 30, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A new model high range beta-gamma survey instrument, was designed which utilizes a circuit similar to that of the older model but incorporates three ranges of 0 to 5 r/hr, 0 to 50 r/hr, and 0 to 500 r/hr. Mercury cells are used for the filament and switching supplies to double the battery life, and the case of the standard CP is used for economy. An enclosed cable tube extension rod is used for ease of decontamination. Circuit diagrams are included. (auth)

3954 HW-38496
[Hanford Atomic Products Operation, Richland, Wash.]
A LARGE AREA ALPHA SCINTILLATION PROBE. W. G. Spear. Aug. 1, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 5p. Contract [W-31-109-Eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

An alpha scintillation probe for use with the HAPO Cart Poppies has been designed to replace the air proportional probes presently used. The new probe has an average geometry of about 15 to 16% over an effective probe area of 23.4 in^2. Stability of operation under normal conditions of vibration, humidity, and temperature are inherent qualities and the average background count is stable at about two counts per minute. The high voltage used is in the order of 1,200 to 1,250 volts with a current requirement of 100 microamperes. (auth)

3955 HW-42225
[Hanford Atomic Products Operation, Richland, Wash.]
APPLICATION AND OPERATION OF THE 325 BUILDING WELL COUNTER. F. P. Brauer. Mar. 8, 1956. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A well-type scintillation counter was constructed to measure the γ activity of liquid samples. The crystal contains a well which allows a tube containing the sample to be inserted in the crystal. The counter was built and calibrated so that γ activity measurements made with it can be easily compared with measurements made with another γ scintillation counter. (C.H.)

3956 HW-43550
Hanford Atomic Products Operation, Richland, Wash.
A COMBINED ALPHA, BETA, GAMMA HAND AND SHOE COUNTER. W. G. Spear, M. O. Rankin, and R. A. Harvey. Nov. 29, 1956. 24p. Contract W-31-109-Eng-52. $0.25 (OTS).

A combination alpha, beta, gamma hand and shoe personnel monitor has been designed which will detect and indicate contamination with a minimum sensitivity of 500 d/m Pu alpha distributed over an eight-inch by three-inch surface and beta-gamma contamination of 50 μc of uranium nitrate solution distributed over an eight-inch by three-inch area of the hand probes. The total monitoring time is fifteen seconds and the combination instrument will cost, by estimate, two-thirds as much as the "Four-Fold" and "Five-Fold" combined. A combination probe is employed utilizing scintillation multiplier phototubes for alpha detection and standard 30 mg/cm^2 glass-wall GM tubes for beta-gamma detection. (auth)

3957 HW-46793
Hanford Atomic Products Operation, Richland, Wash.
TRANSISTORIZED RADIOLOGICAL SURVEY INSTRUMENTS. W. G. Spear. Nov. 28, 1956. 14p. Contract W-31-109-Eng-52. $0.20(OTS).

Standard components to use with portable survey instruments for the measurement of alpha, beta, and gamma contamination and neutron flux are described. In general, these instruments use transistors, with various detectors pertinent to the problems. The components to be described employ transistor circuitry in order to obtain size and weight reduction, ease of maintenance, and long battery life. In all instruments, the count-rate meter circuits and the high voltage supply circuits are standard. (auth)

3958 WADC-TN-55-393
Wright Air Development Center. Materials Lab., Wright Patterson AFB, Ohio.
HIGH INTENSITY GAMMA FLUX DISTRIBUTION MEASUREMENTS USING DOSIMETER GLASS, PHOTO CONDUCTION, AND AN IONIZATION CHAMBER. Roy L. Shipp, Jr. Aug. 1955. 17p. (AD-74328).

The radiation intensity distribution along the vertical axis of a hollow cylindrical 1500-c Co^{60} source was measured with a Victoreen ratemeter, a CdS crystal, and dosimetry glass. The response curves for the three detectors were essentially the same. It is concluded that both CdS crystals and high-silica glass are satisfactory for high-intensity gamma dosimetry. (D.E.B.)

3959 WAPD-RM-115
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
AN IMPROVEMENT IN FISSION COUNTER PERFORMANCE. William Baer and R. T. Bayard. Apr. 1952. Changed from OFFICIAL USE ONLY Oct. 1, 1956. 8p. Contract AT-11-1-GEN-14.

In order to reduce the sensitivity of the Mark I fission counter to gamma rays, a study of its operating characteristics using various gas fillings has been made. The results indicate that a filling of 1 atmosphere of argon with a small amount of nitrogen (instead of the previously used 2 atmospheres of nitrogen) will allow reliable counter operation, increase the speed of the counter in collecting electrons resulting from gas ionization by a fission fragment, and probably decrease the counter sensitivity to gamma radiation. (auth)

3960
ON THE IDENTIFICATION OF STOPPING PARTICLES IN NUCLEAR EMULSIONS. Sigward Nilsson (Univ. of Uppsala, Sweden). Arkiv Fysik 11, 201-16(1956).

Measurements of constant sagitta, mean gap length versus residual range and photometric density versus residual range, have been carried out on 24 stopping protons and 10 π mesons in G5 emulsion. The Fay-Gottstein-Hain $p = 0.5\ \mu$ (protons) and $\pi = 0.5\ \mu$ (π mesons) scattering scheme is calibrated and the conversion factors deduced when calculating the second differences from the third and fourth differences respectively. The photometric density is normalized to minimum tracks and the absolute normalized photometric coefficient and gap coefficient are compared. A linear approximation to the points of photometric density versus residual range in a log-log plot is shown to give reasonable values for sufficiently large ranges. An apparatus for measuring photometrically ionization of tracks in nuclear emulsions adapted for the Cooke microscope, is briefly described. (auth)

3961
THE DETERMINATION OF LINEAR DISTORTION IN NUCLEAR EMULSIONS. A. J. Apostolakis and J. V. Major

(Univ. of Durham, N. C.). Brit. J. Appl. Phys. 8, 9-11(1957) Jan.

The ratio of the linear distortion vector to the curvature distortion vector is found to be (2.03 ± 0.03) within the temperature range (for hot-stage development), of 15 to 24° C. The vectors are found to be in opposite directions. Some consequences of distortion are considered. (auth)

3962

THE USE OF PARALDEHYDE IN ORDER TO INTRODUCE LARGE QUANTITIES OF LABELED C IN A SCINTILLATOR LIQUID. Concele Leger and Louis Pichat. Compt. rend. 244, 190-2(1957) Jan. 7. (In French)

It is shown that it is possible to introduce into a scintillator liquid a considerable quantity of C (425 g/l), by a paraldehyde intermediary. This possibility is particularly interesting in order to detect very weak activities from C^{14}. (tr-auth)

3963

GROWING OF ORGANIC PHOSPHORS FOR SCINTILLATION COUNTERS. Rangalal Bhattacharyya, Uma Basu Roy, and Santimay Chatterjee (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 30, 585-9(1956) Dec.

A simple furnace has been designed and constructed for organic phosphor-crystals. The furnace is described and its mode of operation explained. Conditions for good crystal growth are discussed. (auth)

3964

LIQUID SCINTILLATORS. III. THE QUENCHING OF LIQUID-SCINTILLATOR SOLUTIONS BY ORGANIC COMPOUNDS. Vernon N. Kerr, F. Newton Hayes, and Donald G. Ott (Los Alamos Scientific Lab., N. Mex.). Intern J. Appl. Radiation Isotopes 1, 284-8(1957) Jan.

A study has been made of the quenching characteristics of a large number of selected organic compounds in a few commonly encountered liquid scintillator solutions. From this it should be possible to anticipate the quenching difficulties associated with homogeneous liquid scintillation counting. (auth)

3965

RELATIVE SCINTILLATION INTENSITY OF SOME CERENKOV COUNTER MEDIA. R. Madey and L. Leipuner (Brookhaven National Lab., Upton, N. Y.). IRE Trans. Nuclear Sci. NS-3, No. 4, 61-2(1956) Nov.

Selected transparent media were bombarded with the 40 Mev α-particle beam from the 60-inch cyclotron. The ratio of the photomultiplier output current to the α-particle beam current was taken as a measure of the relative scintillation intensity. The output current from an RCA type 6342 photomultiplier was read on a 50 μa meter. The beam current was monitored by counting α particles elastically scattered from a 0.005-inch Au foil. Preliminary results on the light output from some media relative to that for distilled water are tabulated. Background appeared to give negligible contribution to the scintillation intensity. The background measurement was made by stopping the α beam with a $\frac{1}{16}$-inch Al plate inserted ahead of the substance studied. (auth)

3966

ELECTROPHORETIC DEPOSITS OF BORON, FOR THE CONSTRUCTION OF IONIZATION CHAMBERS. François Michel Lang, Pierre Magnier, and Cécile Finck. J. Nuclear Energy 3, 301-4(1956) Nov. (In French)

Conditions are described for making electrophoresis boron layers of about 1 mg cm^{-2} on discs of aluminum and aluminum alloys. These are used in ionization chambers. (auth)

3967

A PROPORTIONAL COUNTER SYSTEM WITH SMALL WALL EFFECT. R. W. P. Drever, A. Moljk, and S. C. Curran (Univ. of Glasgow). Nuclear Instr. 1, 41-5(1957) Jan.

The wall effects interfering with low energy measurements with proportional counters using gaseous sources are discussed, and a new type of counter in which they are considerably reduced is described. A layer of gas surrounding the sensitive volume is turned into a separate detector by a multiwire counting system which prevents escaping electrons or x rays being registered. Applications to a new measurement of the L/K-capture ratio of Ge^{71}, and to low-level counting, are described. (auth)

3968

BETA-SENSITIVE PERSONNEL DOSIMETER. Harry H. Hubbell, Jr., Raymond M. Johnson, and Robert D. Birkhoff (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 2, 85-9(1957) Feb.

3969

BROAD-RANGE MAGNETIC SPECTROGRAPH. C. P. Browne and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 27, 899-907(1956) Nov.

A broad-range magnetic spectrograph for precise measurement of the energies and intensities of charged particles from nuclear reactions is described. A uniform magnetic field with a circular boundary focuses particles from a source outside the field along a hyperbolic focal surface. Particles with energies varying by as much as a factor of 2.5 may be simultaneously recorded on nuclear-track plates. Under routine operating conditions, an energy resolution of better than 1000 is obtained over the length of the focal surface. The design, construction, testing, and operation of the spectrograph are described, and plots of dispersion, magnification, aberration, and calibration are given. (auth)

3970

NEGATIVE PRESSURE ISOPENTANE BUBBLE CHAMBER. Irwin A. Pless and Richard J. Plano (The Univ. of Chicago, Ill.). Rev. Sci. Instr. 27, 935-7(1956) Nov.

A negative pressure bubble chamber utilizing isopentane for the sensitive fluid is described. The chamber is of all glass construction which gives it a comparatively long sensitive time and allows the use of 90° stereophotography with consequent advantages in the speed and accuracy of analysis. An approximate theory for negative pressure bubble chambers is given. The construction and operation of the chamber is described. (auth)

3971

STATISTICS OF SPURIOUS PULSES FROM HALOGEN-QUENCHED G-M TUBES. Walter G. Egan (New York Naval Shipyard, Brooklyn). Rev. Sci. Instr. 27, 968-9 (1956) Nov.

A study was made of the statistical distribution of the occurrence of spurious peaks when excited by a controlled ionizing event. It was concluded that circuit loading affects spurious peak production and that the distribution differs from that given by an organic-vapor quenched tube. (B.J.H.)

3972

MOUNTING OF STAINED STRIPPING FILM AUTORADIOGRAPHS. M. J. Schlesinger, Hilde Levi, and R. Weyant (Univ. of Michigan, Ann Arbor). Rev. Sci. Instr. 27, 969 (1956) Nov.

3973

INTERMEDIATE-IMAGE PAIR SPECTROMETER. David E. Alburger (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 27, 991-1004(1956) Dec.

An iron-free intermediate-image beta-ray spectrometer has been constructed having a momentum spread (full width at half-maximum) for a point source of conversion electrons continuously variable between limits of 0.5% and 4% with

corresponding transmissions of 1% and 8% of 4π, respectively. The line half-width contribution due to source size is 0.3% per mm of diameter. At a power dissipation of 100 kw the spectrometer focuses electrons of 9-Mev energy allowing positron-electron pair lines corresponding to transitions of up to 19 Mev to be measured using a double-crystal statistical-separation detector together with a fast coincidence circuit. In tests with the 6-Mev nuclear transition in O^{16} using a Van de Graaff beam spot 1 mm in diameter the momentum half width of the pair line can be varied from 0.56% to 2.5% with corresponding absolute transmissions of 0.07 to 6.3 pair counts per 10^5 source transitions, respectively. The energy of this transition has been determined as 6.065 ± 0.009 Mev. Electron-γ and electron-electron coincidence measurements on radioactive sources may be made with the spectrometer in conjunction with crystal detectors placed near the source. (auth)

3974

FAST DETECTOR OF HEAVY PARTICLES. W. E. Stein and R. B. Leachman (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 27, 1049-50(1956) Dec.

A fast, high-efficiency detector of heavy particles that results in negligible changes in the velocity and direction of the detected particles has been built. The detector consists of an electron accelerator and a scintillator that responds to delta particles emitted by the passage of each particle through a thin foil. For fission fragments, time resolutions of 3×10^{-9} sec, with efficiencies greater than 95%, have been obtained. The fragment velocity loss in traversing the thinnest foils used was less than 1%. (auth)

3975

ABERRATIONS AND FRINGING EFFECTS IN A 180° DOUBLE FOCUSSING MAGNETIC SPECTROMETER. David L. Judd and Sidney A. Bludman (Univ. of California, Berkeley). Nuclear Instr. 1, 46-52(1957) Jan.

Second and third order effects, including fringing, are considered for a 180° symmetrical double focusing spectrometer. The optic axis and focal points for particles of a definite momentum are found. Values are calculated for β and γ, the coefficients of the quadratic and cubic terms in the expansion of the magnetic field, which eliminate second and third order aberrations due to radial motion. The linear dispersion and the orientation of the focal plane for paraxial trajectories of slightly different momenta are determined. Numerical values are presented for a high transmission alpha-particle spectrometer designed for this laboratory. (auth)

3976

A SIMPLE RADIATION DETECTOR. L. Ya. Davidchuk and K. V. Chmutov. Zhur. Fiz. Khim. 30, 2807(1956) Dec. (In Russian)

A simply constructed device, consisting of 4 parts, is offered for detection of radioactive pollution in laboratories, work places, clothes, etc. The detector can be operated as an attachment to any radio apparatus or any instrument with a low frequency amplifier (TV, magnetophone, etc.). (R.V.J.)

Refer also to abstracts 3701 and 4118.

MESONS

3977 UCRL-3577

California. Univ., Berkeley. Radiation Lab.
ON THE SPIN OF K MESONS FROM THE ANALYSIS OF ANTIPROTON ANNIHILATIONS IN NUCLEAR EMULSIONS (thesis). Jack Sandweiss. Oct. 31, 1956. 35p. Contract W-7405-eng-48. $0.30(OTS).

The antiproton-nucleon annihilation process has been shown to proceed primarily through pion production with occasional emission of K mesons. The fraction of stars yielding $K-\overline{K}$ pairs (conservation of "strangeness" is assumed) depends upon the spin, I, of the K mesons. A statistical-theory method has been developed for analyzing the annihilation data for information regarding the K-mesons' spin. The theory employed is essentially that of Fermi; however, conservation of angular momentum has been included and the interaction volume is treated as an adjustable parameter. It was found that I = 0 is most likely for the K mesons but, with present data, higher values cannot be excluded. Under favorable circumstances this analysis may also yield information about the number of distinct types of K mesons. Various experimental tests have been devised to investigate the validity of the assumptions of the statistical-theory analysis. The existing data are consistent with the validity of these assumptions. (auth)

3978 UCRL-3580

California. Univ., Berkeley. Radiation Lab.
ANALYSIS OF BEVATRON TAU MESONS (thesis). Roy Phillip Haddock. Nov. 5, 1956. 67p. Contract W-7405-eng-48. $10.80(ph OTS); $3.90(mf OTS).

One hundred and seventy-seven τ^+ mesons, obtained from large nuclear emulsion stacks exposed to the Kerth-Stork K^+ beam at the Bevatron and located by systematic track-following, are analyzed for Q value of the tau decay, tau spin and parity, and possible polarization effects. A Q of 75.13±.20 Mev is obtained. The corresponding tau mass is 966.5±.74 m_e. A relativistic treatment of the Dalitz analysis was used to assign the tau spin-parity. The observed energy and angle distributions do not agree with any of the cases compatible with the decay of the tau into two pions whereas the cases (0-), (2-), (3+) were about equally probable and no final conclusion concerning the spin was possible. In this connection no polarization effect was found, which does not contradict a pseudoscalar meson. (auth)

3979

THE CAPTURE OF A Σ^--HYPERON WITHOUT ANY VISIBLE INTERACTION. K. Kristiansson and T. Johansson. Arkiv Fysik 11, 277-80(1956).

In a nuclear emulsion an event has been found which can be explained as a Σ^- hyperon coming to rest, interacting with a nucleus and giving a 0-prong star. The hyperon has been identified by mass determinations according to four different methods. The probability of Σ^- hyperons giving 0-prong stars is discussed. (auth)

3980

ON THE GENERAL THEORY OF MESON SCATTERING. A. Brodskii (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 111, 787-90(1956) Dec. 1. (In Russian)

Recently some of Green's single component functions were expressed as integrals of certain scalar functions based on general conditions of the theory. An attempt is made to use analogous integrals renormalized to express the scattering amplitude of mesons on nucleons. (R.V.J.)

3981

INTERACTIONS OF 85-MEV POSITIVE PIONS WITH DEUTERONS. Kenneth C. Rogers and Leon M. Lederman (Columbia Univ., New York). Phys. Rev. 105, 247-55(1957) Jan. 1.

Collision processes of pions with deuterium have been observed in a diffusion cloud chamber. The use of positive pions rendered visible all of the possible reactions at 85 Mev. Total cross sections and angular distributions for elastic and inelastic scattering, charge exchange scattering, and absorption have been determined from 272 collisions in

the deuterium gas. The results are compared with the phenomenological impulse-approximation theory. (auth)

3982

LIFETIME OF THE τ^+ MESON. R. Motley and V. Fitch (Princeton Univ., N. J.). Phys. Rev. 105, 265-6(1957) Jan. 1.

K^+ meson lifetime measurements by counter techniques have been extended to include the τ^+ or $K_\pi{}^+$ meson. A maximum-likelihood analysis of the data yields a mean life of $(11.7_{-0.7}{}^{+0.8}) \times 10^{-9}$ sec. The previously reported mean life of the $K_{\pi 2}{}^+$ is $(12.1_{-1.0}{}^{+1.1}) \times 10^{-9}$ sec. With 95% confidence the difference between the lifetimes of the two particles is less than 20% of their arithmetic mean. (auth)

3983

NEGATIVE TO POSITIVE RATIO FROM NONRELATIVISTIC THEORIES OF PION PHOTOPRODUCTION. Michael J. Moravcsik (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 267-77(1957) Jan. 1.

A numerical evaluation of the Low theory of charged photoproduction is given in various approximations, including also nonrelativistic recoil of the nucleon. Enhancement of only that part of the ($P_{3/2}$, $3/2$, M1) term which is due to interaction with the nucleon current gives reasonably good agreement with experimental data up to 440 Mev. The effect of recoil corrections is hardly discernible in the shape of the angular distribution. The differential cross section is also calculated from a modified version of the theory, called the "adjusted" theory, in which the S-wave terms are taken from perturbation theory. This version of the theory gives an equally good fit to the data. The negative to positive ratio is then calculated in the various approximations. It is found that these approximations give nearly the same ratio, although the corresponding predictions of differential cross section for the positive pion production differ greatly. This common prediction for the ratio agrees quite well with the experimental data, especially in the case of the "adjusted" theory. (auth)

3984

LIFETIMES OF τ, $K_{\mu 3}$, AND K_e DECAY MODES. T. F. Hoang, M. F. Kaplon, and G. Yekutieli (Univ. of Rochester, N. Y.). Phys. Rev. 105, 278-84(1957) Jan. 1.

The proportions of the various decay modes of K^+ mesons produced by the 2.9-Bev proton beam of the Brookhaven Cosmotron have been investigated in two emulsion stacks separately exposed at different distances from the target. An analysis of the observed ratios of different decay modes has been made in order to determine the various partial lifetimes, the $K_{\mu 3}$ and $K_{\pi 2}$ lifetimes being used as a secondary standard. The results indicate that within experimental error all the partial lifetimes are consistent with a unique value. (auth)

3985

DECAY OF CHARGED K MESONS. R. Arnowitt and W. B. Teutsch (The Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 105, 285-7(1957) Jan. 1.

The decay of the charged K meson is considered under the assumption of the existence of two parity-conjugate particles with zero spin. The effect of a weak parity-mixing interaction, which may be of environmental or intrinsic origin, is studied. Two limiting cases are examined. If the parity-mixing interaction is weaker than the usual decay interactions, then the θ and τ mesons will appear to have the same lifetime far from their point of production; however, near the point of production a difference in their lifetimes should be discernible. On the other hand, if the parity-mixing interaction is somewhat larger than the decay interactions, only a single lifetime would occur. Ordinary decay experiments will not serve to distinguish between the latter case and the existence of a single kind of K meson which decays without parity conservation. (auth)

3986

NOTE ON THE DECAY INTERACTIONS OF HYPERONS AND HEAVY MESONS. Chikashi Iso and Masaaki Kawaguchi (Tokyo Univ. of Education and Kyoto Univ.). Progr. Theoret. Phys. (Japan) 16, 177-88(1956) Sept.

The decay processes are investigated based on Nishijima and Gell-Mann's charge independence theory of heavy unstable particles. It is assumed that the decay interaction Hamiltonian is a spinor in isotopic spin space, when all particles participating in a decay process have definite isotopic spins. The branching ratio of various decay modes including radiative decays and the relation of lifetimes among charge multiplets are obtained. For instance, the difference between lifetimes of θ^0 and of θ^+, and the branching ratio of the τ^+ particle are well interpreted under our assumption. The theory is also applied to the decay of the lightest hyperfragment ${}^3H_\Lambda$. (auth)

3987

ON THE DETERMINATION OF THE SPINS OF Λ^0 AND θ^0 PARTICLES. Shoichi Hori (Kanazawa Univ.). Progr. Theoret. Phys. (Japan) 16, 189-96(1956) Sept.

A complete angular correlation function is derived, which is concerned with the directions of decay secondaries from Λ^0 and θ^0 particles produced in a π^--p collision and of the incident π^- meson. The function is evaluated for a simplified case in which it is assumed that the spin of θ^0 is zero and the $\Lambda^0-\theta^0$ system is produced in S-state in center of mass system. For the case of the spin of $\Lambda^0 = 3/2$, the result agrees with that reported by L. Wolfenstein. (auth)

3988

NOTE ON THE DECAY OF Ξ PARTICLE. Shigeaki Hatano (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 16, 248-9 (1956) Sept.

The decay of the Ξ particle is discussed in mathematical form where the Ξ is regarded to be a bound system of Λ and anti-K particle. (B.J.H.)

3989

ON THE NUCLEAR INTERACTION OF μ-MESON BELOW GROUND. Takashi Kitamura and Minoru Oda (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 16, 252-4(1956) Sept.

3990

PRODUCTION OF SLOW π^+ MESONS IN PHOTOGRAPHIC EMULSION NUCLEI BY 660 MEV PROTONS. V. V. Alpers, L. M. Barkov, R. I. Gerasimova, I. I. Gurevich, A. P. Mishakova, K. N. Mukhin and B. A. Nikol'skii. Soviet Phys. JETP 3, 735-9(1956) Dec.

The study of the formation of π^+ and π^- mesons in the nuclei of photo-emulsions by fast nucleons was continued and results were obtained with 660-Mev protons. Stars formed by π^- mesons as well as the energy and angular spectra of the slow π^+ mesons were studied. (F.S.)

3991

THE θ-MESON AND THE FERMI-YANG HYPOTHESIS. V. I. Karpman (Minsk Inst.). Soviet Phys. JETP 3, 754-5(1956) Dec.

The theta meson is considered as a composite particle consisting of a nucleon and antihyperon or an antinucleon and hyperon. (F.S.)

3992

PRODUCTION OF A NUCLEAR STAR AND π-MESON BY A GAMMA PHOTON. Iu. A. Vdovin (Physico-Engineering Inst., Moscow). Soviet Phys. JETP 3, 755-7(1956) Dec.

In the production of a π-meson pair by a collision between a photon and a nucleus, one of the mesons of the π-meson

pair was absorbed in the nucleus and produced a nuclear star and a fast π-meson carried off energy of the order of the total energy of the star. This process was studied with the aid of a radiation transition matrix element in which the absorbed meson is represented as a spherical wave converging on an arbitrary point of the nucleus. (F.S.)

3993

CONCERNING THE RADIATIVE CORRECTION TO THE μ-MESON MAGNETIC MOMENT. V. B. Berestetskii, O. N. Krokhin and A. K. Khlebnikov. Soviet Phys. JETP 3, 761-2 (1956) Dec.

3994

INTERACTION OF π^--MESONS WITH PROTONS AT 4.5 BEV. A. I. Nikishov. Soviet Phys. JETP 3, 783-4(1956) Dec.

3995

CAPTURE OF K^--MESONS BY DEUTERIUM AND HYPERON-NUCLEON INTERACTION. L. B. Okun' and M. I. Shmushkevich (Academy of Sciences, USSR). Soviet Phys. JETP 3, 792-3(1956) Dec.

K-meson capture in hydrogen and deuterium was studied for information concerning the properties of K mesons and the interactions between hyperons and nucleons. (F.S.)

3996

TWO τ-MESONS DETECTED IN PHOTOGRAPHIC EMULSIONS. I. M. Gramenitskii, E. A. Zamchalova, M. I. Podgoretskii, M. I. Tret'iakova and M. N. Shchervakova (P. N. Lebedev Physical Inst., Academy of Sciences, USSR). Soviet Phys. JETP 3, 807-9(1956) Dec.

Characteristics of τ mesons found in a stack, consisting of 126 layers of unbacked electron-sensitive emulsions of type R, exposed for 7 hours at a height of 27 km were studied. The comparatively small energy of one of the π^+ mesons produced by a τ meson supports the hypothesis that the τ and χ mesons are different particles. (F.S.)

3997

DIFFRACTION SCATTERING OF HIGH ENERGY π-MESONS BY NUCLEI. S. Z. Belen'kii (P. N. Lebedev Physical Inst., Academy of Sciences, USSR). Soviet Phys. JETP 3, 813-15 (1956) Dec.

The diffraction scattering in collisions between high-energy π mesons and nucleons was treated on the basis of general theory without any special assumption as to the nucleonic model and neglecting the spin dependence of nuclear forces and the change of the charge of π mesons in collisions with protons. (F.S.)

3998

PRODUCTION OF SLOW π^+-MESONS IN PHOTOGRAPHIC EMULSION NUCLEI BY 460 MEV PROTONS AND NEUTRONS OF 400 MEV EFFECTIVE ENERGY. V. V. Alpers, L. M. Barkov, R. I. Gerasimova, I. I. Gurevich, K. N. Mukin, B. A. Nikol'skii, and E. P. Toporkova. Soviet Phys. JETP 3, 914-20(1957) Jan.

The method of an emulsion chamber was used to investigate the production of charged mesons by 460-Mev protons and neutrons of 400 Mev effective energy. (auth)

3999

THE SPIN OF THE Λ-PARTICLE. I. Iu. Kobzarev and L. B. Okun'. Soviet Phys. JETP 3, 954-5(1957) Jan.

It is shown that a large spin model of the Λ particle does not agree with experimental facts concerning the particles. (B.J.H.)

4000

THE ENERGY SPECTRUM OF γ-QUANTA FROM DECAYING π^0-MESONS. A. A. Tiapkin. Soviet Phys. JETP 3, 979-80(1957) Jan.

Equations are given which describe the γ energy spectrum from the decay of π^0 mesons. (B.J.H.)

4001

THE DISINTEGRATION AND MASS DIFFERENCE OF HEAVY NEUTRAL MESONS. Ia. B. Zel'dovich (Academy of Sciences, USSR). Soviet Phys. JETP 3, 989-91(1957) Jan.

The behavior of heavy neutral θ mesons is briefly considered. (B.J.H.)

4002

ANGULAR CORRELATION IN CASCADE DECAY OF HYPERONS. V. B. Berestetskii and V. P. Ignatenko. Soviet Phys. JETP 3, 991-3(1957) Jan.

The cascade decay $\Sigma^0 \rightarrow \Lambda^0 + \gamma \rightarrow p + \pi^- + \gamma$ is considered. Equations describing the angular correlations in the decay are given. (B.J.H.)

Refer also to abstract 4115.

MOLECULAR PROPERTIES

4003 ISC-672

Ames Lab., Ames, Iowa.

THE ABSOLUTE INFRARED ABSORPTION BAND INTENSITIES OF THE METHYLENE GROUP VIBRATIONS OF SOME METHYLENE HALIDES. Richard Hedges and Harrison Shull. Aug. 1955. 39p. Contract W-7405-eng-82. $0.30(OTS).

4004 ORNL-2118

Oak Ridge National Lab., Tenn.

DESCRIPTION AND VIBRATIONAL ANALYSIS OF THE MOLECULAR SPECTRUM OF POLONIUM. G. W. Charles, D. J. Hunt, G. Pish, and D. L. Timma. Jan. 29, 1957. 44p. Contract W-7405-eng-26. $0.30(OTS).

Spectrograms of the molecular spectrum of Po excited in an electrodeless discharge have been measured. Approximately 500 red-shaded band heads were found with mixtures of Po^{208} and Po^{209} and approximately 450 heads with Po^{210}. Nearly 350 bands have been classified in each spectrum into a system represented by the equation (for Po^{210}) $\sigma = 25{,}149.3 + 108.53\,(\nu' + 1/2) - 0.4417\,(\nu' + 1/2)^2 - 155.715\,(\nu'' + 1/2) + 0.3353\,(\nu'' + 1/2)^2 + 0.0003226\,(\nu'' + 1/2)^3$. The values of the constants in this equation and the close agreement between calculated and observed isotope shifts prove that the emitter is diatomic Po. Extrapolation of the observed energy levels to convergence yields an estimate of 1.895 volts for the dissociation energy of the lower state of Po^{210}-Po^{210}, based on the assumption that the dissociation products are two normal polonium atoms. An historical survey of Group VI diatomic molecular spectra and a critical evaluation of the status of knowledge of these spectra are included. (auth)

4005

MODELS RELATING MOLECULAR REACTIVITY AND DIFFUSION IN LIQUIDS. Richard M. Noyes (Columbia Univ., New York). J. Am. Chem. Soc. 78, 5486-90(1956).

Models are developed by which the tendency of an isolated pair of molecules to react with each other is related to the frequency and magnitude of relative diffusive displacements. Although most experimental tests will show little discrimination, the individual parameters of diffusive motion can be estimated from the effect of scavenger concentration on quantum yield of photochemical dissociation. Data currently available suggest that diffusion in liquids involves almost continuous motion and small individual displacements, and does not involve "jumps" of the order of a molecular diameter that are opposed by significant potential barriers. (auth)

NEUTRONS

4006 CF-55-8-193
Oak Ridge School of Reactor Technology, Tenn.
A MONTE CARLO CALCULATION OF THE FERMI AGE AND OTHER PROPERTIES OF THE SLOWING DOWN DISTRIBUTION. Henry C. Honeck. Aug. 1955. 30p. $0.25(OTS).

A program was developed for the ORACLE which computes the second moment of the slowing down distribution of neutrons in a mixture of elements. The program allows mixtures of up to eight elements, four of which have scattering, absorption, and transport cross sections, and four which have only absorption cross sections. Provision is made to calculate other properties of the slowing down system, such as the average diffusion coefficient, the resonance escape probability, and the squared first and last flight mean free paths. (auth)

4007 HW-44749
[Hanford Atomic Products Operation, Richland, Wash.]
NEUTRON LEAKAGE THROUGH IRON. D. E. Wood. July 25, 1956. Decl. Jan. 23, 1957. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A rough calculation using the Fermi age theory was used to study the spectrum of neutrons leaking through pure Fe. Curves are shown to illustrate the general features of the spectrum. The curves show that leakage is large at energies below 100 kev. Thus it can be concluded that as a shield configuration approaches pure Fe, the intermediate energy leakage increases rapidly, while in new shields, leakage will be primarily from fast neutrons. (B.J.H.)

4008 WAPD-P-439
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE EFFECT OF THE DOPPLER BROADENING ON THE RESONANCE ABSORPTION IN HOMOGENEOUS MIXTURES. R. L. Hellens. May 1954. Changed from OFFICIAL USE ONLY Oct. 3, 1956. 11p. Contract [AT-11-1-GEN-14]. $3.30(ph OTS); $2.40(mf OTS).

Resonance integrals are derived and numerically evaluated. The results are given in graphical form and show the effect of Doppler broadening on the absorption. (B.J.H.)

4009
INELASTIC CROSS-SECTIONS FOR FISSION-SPECTRUM NEUTRONS. II. H. A. Bethe, J. R. Beyster, and R. E. Carter (Los Alamos Scientific Lab., N. Mex.). J. Nuclear Energy 3, 273-300(1956) Nov.

Discussions are included on the topics of anisotropic scattering and the justification of the transport approximation in calculation, the determination of escape probabilities, and the various corrections to be made in calculations. (B.J.H.)

4010
SCATTERING OF FAST NEUTRONS BY NONSPHERICAL NUCLEI. III. S. I. Drozdov. Soviet Phys. JETP 3, 759-61 (1956) Dec.

The effective cross section was calculated for the scattering of fast neutrons by odd nuclei with spins different from zero. (F.S.)

NUCLEAR PHYSICS

4011 AERE-NP/M-74
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A METHOD FOR THE ESTIMATION OF THE AREA UNDER A NUCLEAR RESONANCE CURVE OBTAINED WITH A TIME-OF-FLIGHT SPECTROMETER. J. E. Evans. May 2, 1955. 5p.

4012 CERD-S1C-108
Combustion Engineering, Inc. Reactor Development Div., New York.
HEAT GENERATION BY INELASTIC SCATTERING GAMMA RAYS. J. P. Davis. Apr. 9, 1956. 12p. $0.15 (OTS).

The calculation of heat generation rates from γ rays arising from thermal neutron capture is reviewed. The problem is outlined in slab geometry considering an arbitrary spatial neutron flux distribution and gamma energy spectrum. Build-up is accounted for using the Taylor two-term exponential fit for energy absorption build-up factors. The problem is extended to the calculation of heat generation rates from inelastic scattering γ rays assuming the Weisskopf statistical model for the neutron energy degradations. The use of a multi-group, multi-region machine code to obtain the energy dependent neutron flux taking inelastic scattering into account is outlined. (auth)

4013 HW-40345(Del.)
Hanford Atomic Products Operation, Richland, Wash.
PHYSICS RESEARCH QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1955. Dec. 7, 1955. Decl. with deletions Jan. 21, 1957. 43p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

A new method of calculating resonance escape probabilities, results for the effective mass of a proton bound in the water molecule, and a comparison of similar techniques for calculating lattice constants developed independently by Hanford physicists and by a school of Russian physicists (as reported at the Geneva Conference) are reported. An estimate of maximum errors in f and η for thermal systems is described. Experiments and analysis thereof on the effects of neutron streaming in air channels through a moderator are reported. Buckling calculations and experimental results are given for graphite lattices employing 1.17-inch diameter natural U slugs and U^{235}–Al alloy slugs. An experimental measurement of the critical mass of an annular cylindrical array is described. Some measurements on, and the status of, construction of the Lattice Testing Reactor are reported. Development of a BF_3 counter suitable for operation at elevated temperatures is described. A method of determining the screening parameter in the Thomas-Fermi model of the atom is given for use in calculating atomic displacements produced by radiations in crystals. Calculated results are reported for chain-reacting concentration limits of U–Pu–H_2O systems. (auth)

4014 HW-46697
Hanford Atomic Products Operation, Richland, Wash.
PENETRATION OF GAMMA RAY SECONDARIES. W. C. Roesch. Sept. 28, 1956. 28p. Contract W-31-109-Eng-52. $0.20(OTS).

The age theory of beta ray penetration was applied to the penetration of secondary electrons produced by γ rays. The relation between exposure dose (roentgens) and absorbed dose (rads) was calculated for the boundary between two media, near a point source, and in a uniform medium in which exponential attenuation of the exposure dose is allowed for. The Bragg-Gray principle and similar principles applying to large ion chambers and to chambers with two different wall materials were derived. The theory was used to help understand the response of x-ray film to γ rays of different energies. (auth)

4015 NP-6187
Leiden. Universiteit.
ELECTRON CAPTURE AND LOSS AND IONIZATION IN

IONIC AND ATOMIC IMPACT PHENOMENA (thesis). Frederik Jacques de Heer. [June 6, 1956]. 120p.

The different applied methods to determine the capture, loss, and ionization cross sections are summarized. Complete descriptions are given of the apparatus used. Experimental evaluations of the cross sections are included. (B.J.H.)

4016 ORNL-2204

Oak Ridge National Lab., Tenn.

PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 10, 1956. Feb. 12, 1957. 81p. Contract W-7405-eng-26. $0.50(OTS).

A procedure for obtaining finite mass corrections in relativistic quantum field theories is reported. A new derivation is given for the energy dependence of the Wigner-Eisenbud R matrix. Quantum mechanical states are shown to decay no more rapidly than some inverse power of the time for sufficiently large times. ORACLE calculations pertaining to the design of an electron model for a straight four-sector Thomas type cyclotron are described. Angular distributions and polarization-direction correlations were measured for the γ rays following coulomb excitation in Tl^{203}, Tl^{205}, Au^{197}, Ir^{191}, Ir^{193}, Os^{188}, Os^{190}, Os^{192}, Ag^{107}, Ag^{109} and Mo^{95}. The yield of the 2.31 Mev γ rays from inelastic proton scattering by the first excited state of N^{14} was measured for proton energies from 2.5 to 5.1 Mev. Absolute (p,n) cross sections are reported for Ti^{49}, V^{51}, Mn^{55}, Ga^{71}, and As^{75} for proton energies from 0 to 500 kev above threshold. The total cross section of C^{12} was measured in the region of the 2.07 Mev resonance. Elastic neutron scattering differential cross sections for 0 and Be at E_n = 0.73 and 1.50 Mev are reported. Neutron resonance parameters for Eu^{151} and Eu^{153} from 1 to 10 ev are given. Cross sections for electron loss by fast H atoms in various stopping gases in the energy range 250 to 1000 kev were measured. The charge spectrometer was used to study the breakup of the HT molecule following β decay. A probability of 90% that the molecule will hold together as He^3H^+ is indicated. Neutron-diffraction evidence for antiferromagnetic ordering of rare earth ions in $ErFeO_3$ and Er_2O_3 is described. Investigations of the diffuse scattering of neutrons from $FeCl_2$ and $CoCl_2$ near the Neel temperatures show that ferromagnetic coupling is predominant in these antiferromagnetic structures. A new amplifier has been developed for spectrometry which has good overload tolerance, fast pulse response, high gain, stability, and linearity. The variation of NaI crystal detection efficiency with size and geometry was measured. Further angular distribution measurements on α particles emitted by partially orientated Np^{237} and U^{233} were made. A theoretical discussion of the results is given. (For preceding period see ORNL-2076.) (D.E.B.)

4017

THE NUCLEAR PROPAGATOR FUNCTION IN QUADRATIC APPROXIMATION. V. G. Solov'ev (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 111, 578-81(1956) Nov. 21. (In Russian)

Green's functions in pseudoscalar symmetric meson theory with pseudoscalar coupling were analyzed mainly from the mathematical point of view. The basis of the new method for developing Green's functions of approximation, named the "quadratic approximation," was introduced in the investigation. The method was calculated for application to small energies. (R.V.J.)

4018

ON THE COLLECTIVE ROTATIONAL MOTIONS OF NUCLEI. R. S. Nataf (Univ. of Edinburgh). Nuclear Phys. 2, 497-525(1957) Jan. (In French)

A. Bohr and B. R. Mottelson have forecast the rotational nuclear levels by their unified model in which collective motions (liquid drop) and individual motions (shell model) are coupled. Attempts have been made to derive this compound Hamiltonian from the Schrödinger one for the nucleus, by a method in which the collective variables are expressed in terms of the coordinates of the nucleons—and then taken as redundant variables. A study of these coordinate transformations failed to lead to the well known rotational levels. (auth)

4019

REPULSION OF NUCLEAR LEVELS. I. I. Gurevich and M. I. Pevsner (USSR Academy of Sciences, Moscow). Nuclear Phys. 2, 575-81(1957) Jan.

The size distribution of level spacings in the region of compound nucleus excitation energies of the order of the neutron binding energy is considered. By analyzing available data derived by neutron spectroscopy, it is shown that the actual size distribution of level spacings qualitatively differs from random distribution. The relative number of near-lying levels is considerably smaller than for a random distribution. The conclusion is drawn that nuclear levels "repel" each other with a distribution approaching equidistance. This conclusion is based on experimental data relating mainly to odd-mass target nuclei. Assuming naturally that only equal spin levels interact, the observed "repulsion" may prove to be less pronounced owing to overlapping of the two sets of levels. (auth)

4020

MAGNETIC MOMENTS OF NUCLEI AND THE NUCLEAR MANY-BODY PROBLEM. J. S. Bell, R. J. Eden, and T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Nr. Didcot, Berks). Nuclear Phys. 2, 586-92 (1957) Jan.

In recent work on the nuclear many-body problem, momentum-dependent potentials have been used to describe the motion of individual particles, and this has led to some uncertainty in regard to electromagnetic interactions, especially magnetic moments. The causes of momentum dependence of the potentials are discussed, and it is shown that some of these do not lead to any change in magnetic moments, while others may affect them but not simply in the way indicated by the 'reduced mass' approximation to the potentials. The magnetic moment operator is in any case ambiguous in that it involves the unknown functions familiar from studies of exchange currents. (auth)

4021

EFFECT OF THE ATOMIC CORE ON THE NUCLEAR QUARDRUPOLE COUPLING. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 158-69(1957) Jan. 1.

The effect of the atomic core on the nuclear quadrupole coupling has been evaluated for several atomic ground states and excited states. It has been shown that for the excited states of the alkalis, as the principal quantum number n is increased, the ratio R of the induced effect to the direct interaction with the valence electron tends toward a constant asymptotic value which is of the same order as for the first excited state (~ -0.1 to -0.3). The sensitivity of R to inaccuracies in the zero-order core wave functions and valence wave functions has been investigated. Equations have been derived for the exchange terms in the quadrupole coupling due to the perturbation of the valence wave function by the nuclear quadrupole moment. The present calculations indicate that the exchange terms do not affect significantly the net antishielding obtained for the excited states of the alkalis. (auth)

4022

CALCULATION OF PHENOMENOLOGICAL NUCLEON-NUCLEON POTENTIALS. J. L. Gammel, R. S. Christian,

and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 311-19(1957) Jan. 1.

An attempt to find a phenomenological nucleon-nucleon potential is described. The class of charge and velocity independent potentials with central and tensor parts of Yukawa shape with a hard core is considered. The depths, ranges, and core radii of such potentials with general spin and parity dependence are adjusted to fit experimental data. No potential of this type is found which fits all of the data. (auth)

4023

SOME REMARKS ON THE NUCLEAR LEVEL SPACING. Yoichi Fujimoto, Fumio Fukuzawa, and Sueji Okai (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 16, 246-8(1956) Sept.

It is pointed out that level spacing has an exponential distribution in size. Data from various nuclides are combined and shown graphically. Formulas are derived to describe the level spacing. (B.J.H.)

4024

NUCLEAR DEFORMABILITY AND SHELL STRUCTURE. Toshio Marumori and Shota Suekane (Kyoto Univ.) and Atsuko Yamamoto (Nagoya Univ.). Progr. Theoret. Phys. (Japan) 16, 320-40(1956) Oct.

The connection between the surface rigidity of the nuclear core, which has been accounted for in terms of the surface tension of liquid drop nuclei, and its proper shell structure is discussed by using the method of the quantum mechanical description of the collective motion, which has been proposed by one of the present authors and others. On the basis of such a consideration the surface rigidity of the core can be calculated, provided that the shell model is valid for the behavior of particles forming the core. The noticeable features of the results obtained are that the calculated values of rigidity of cores are, in general, considerably larger than those due to the hydrodynamical estimation, and are closely related to the proper shell structures of cores. Such a characteristic variation of the rigidity of cores is discussed in detail by comparing with the quadrupole moments of the "core ± one extra-particle type" nuclei. Theoretical quadrupole moments thus obtained explain the observed values which have been noticed to depend on the shell structure. Some discussions are devoted to the rigidity of a core with large deformation. (auth)

4025

ON THE EFFECTS OF HEAVY UNSTABLE PARTICLES TO THE ANOMALOUS MAGNETIC MOMENTS OF NUCLEONS. Chikashi Iso (Tokyo Univ. of Education) and Syurei Iwao (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 16, 417-20(1956) Oct.

4026

THE CREATION OF AN ELECTRON PAIR BY A FAST CHARGED PARTICLE. Toshiyuki Murota and Akira Ueda (Kyoto Univ.) and Hajime Tanaka (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Japan) 16, 482-96(1956) Nov.

Using the Feynman-Dyson method, the cross section for the creation of an electron pair by a fast charged particle is calculated but in a manner more precise than that of Bhabha and others. The differential cross section obtained here is valid as long as the energies of participant particles are large compared with the respective rest masses. The ambiguities in Bhabha's calculation are also examined. It is concluded that the theoretical value must be compared with the experimental results produced by high energy electrons ($\gtrsim$ 10 Bev). (auth)

4027

ON ANNIHILATION OF ANTIPROTONS WITH STAR FORMATION. S. Z. Belen'kii and I. S. Rozenthal' (P. N. Lebedev Physical Inst., Academy of Sciences, USSR). Soviet Phys. JETP 3, 786-7(1956) Dec.

4028

NEUTRINO-INDUCED DEUTERON DISINTEGRATION. A. B. Govorkov. Soviet Phys. JETP 3, 812-13(1956) Dec.

The antineutrino absorption cross section for deuterons was studied. (F.S.)

4029

BINDING ENERGY OF HYPER-NUCLEI. D. Ivanenko and N. Kolesnikov (Moscow State Univ.). Soviet Phys. JETP 3, 955-7(1957) Jan.

Some remarks are made concerning the properties of hypernuclei, those nuclei which contain a Λ^0 particle in addition to neutrons and protons. Values for the binding energy of a series of light nuclei are plotted, thus illustrating the dependence of the binding energy of Λ^0 particles on the number of nucleons. It is seen that the binding energy increases with the number of nucleons and that it is independent of the spin or charge of the nuclear part. (B.J.H.)

4030

ONE-MESON AND ZERO-MESON ANNIHILATION OF ANTINUCLEONS. B. M. Pontecorvo. Soviet Phys. JETP 3, 966-7(1957) Jan.

The possibility of antinucleon annihilation processes, in which the number of π mesons emitted is one or zero, is considered for the case where antinucleons collide with nucleons bound to a nucleus. (B.J.H.)

4031

CHARGE DISTRIBUTION OF MESONS IN NUCLEON-ANTINUCLEON ANNIHILATION. A. I. Nikishov. Soviet Phys. JETP 3, 976-7(1957) Jan.

The charge distribution of mesons in nucleon-antinucleon annihilation is calculated on the basis of isotopic spin conservation. The results are tabulated. (B.J.H.)

4032

TWO MODELS FOR THE NUCLEAR PHOTOEFFECT. J. S. Levinger (Louisiana State Univ., Baton Rouge). Rev. mex. fis. 5, 177-84(1956) Oct.

The Migdal-Jensen collective model and the Wilkinson shell model both give reasonable agreement with photonuclear experiments concerning the integrated cross section, the resonance energy, and the width of the resonance. Possible reasons for the similarity between the predictions of the two different models are discussed. Experiments on emission of fast nucleons show that the excited state reached by electric dipole photon absorption contains a large amplitude of shell model wave functions representing single particle excitation. (auth)

NUCLEAR PROPERTIES

4033 AERE-N/M-62

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE THERMAL NEUTRON CROSS-SECTION OF BORON. P. A. Egelstaff. Nov. 3, 1953. Decl. Nov. 20, 1956. Includes Appendix: THE PREPARATION OF A BORON SOLUTION FOR NEUTRON TRANSMISSION MEASUREMENT. E. Bowell. 13p.

The capture cross sections of B for 2200 m per sec neutrons was determined by transmission measurements to be 781 ± 10 b. (auth)

4034 NRDC-51

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ABSOLUTE VALUES OF THE FISSION CROSS SECTIONS OF SEVERAL ISOTOPES. J. F. Raffle. Oct. 25, 1954. 6p.

Determinations are reported for Pu^{239}, Pu^{241}, U^{233}, and U^{235}. Measurements were made using 2200 m per sec neu-

trons and thermal neutrons from the core of BEPO. The methods used are reviewed and the results are summarized. (D.E.B.)

4035

RESEARCH ON THE COULOMB EXCITATION OF THE SECOND LEVEL OF Pt^{194}. Roland Barloutaud, Tovy Grjebine, Pierre Lehmann, Antoine Lévêque, Jacques Quidort and Georges M. Temmer. Compt. rend. 244, 187-90(1957) Jan. 7. (In French)

The absence of Coulomb excitation of the second level of Pt^{194} allows one to fix a value of the upper limit of the reduced probability E_2 which is eight times smaller than that predicted by the interpretation of this level as a vibration level. (B.J.H.)

4036

INTERACTIONS OF FAST π MESONS WITH NUCLEI. L. P. Kudrin and B. A. Nickol'skiĭ. Doklady Akad. Nauk S.S.S.R. 111, 795-8(1956) Dec. 1. (In Russian)

Interactions of high energy π mesons with the nucleonic nucleus were investigated as the method for determining the nuclear properties. Comparative studies were made of experimental calculations for 160 Mev π-meson inelastic scattering by photoemulsion nuclei with the assumption that the same would hold in the process of individual meson-nucleon collisions within the nucleus. (R.V.J.)

4037

C^{13} NUCLEAR MAGNETIC RESONANCE SPECTRA. Paul C. Lauterbur (Mellon Inst., Pittsburgh). J. Chem. Phys. 26, 217-18(1957) Jan.

Nuclear magnetic resonance spectra of C^{13} in natural abundance have been observed in over 100 compounds and the chemical shifts and indirect spin-spin couplings are given for 60 of these. (auth)

4038

STRESS ACTIVATED LUMINESCENCE IN X-IRRADIATED ALKALI HALIDE CRYSTALS. F. I. Metz, R. N. Schweiger, H. R. Leider, and L. A. Girifalco (National Advisory Committee for Aeronautics, Cleveland). J. Phys. Chem. 61, 86-9 (1957) Jan.

The luminescence caused by stressing crystals of KBr, NaCl, and LiF containing F-centers produced by X-rays has been investigated in the region of plastic flow. Light output was measured under varying conditions of irradiation time and strain rate. Rate of light output shows a linear dependence on strain rate (from 12.1 to 116 per cent/min) for all three materials. It is shown that a process by which F-center electrons are excited to the conduction band by thermal spikes associated with the movement of dislocations, with subsequent recombination with a vacancy or a halogen atom, can account for the experimental observations. (auth)

4039

ON THE NUCLEAR ABSORPTION OF PHOTONS. C. Tzara. J. phys. radium 17, 1001-4(1956) Dec. (In French)

A particularly intense resonance in the absorption of photons by C^{12} exists at 22.8 Mev; at this energy, the slope of the activation curve for the (γ,n) reaction has a discontinuity attributed to a level of width $\Gamma < 40$ kev. The upper limit found for the effective absorption cross section yields a width $\Gamma_n > 400$ kev for this level, in contradiction with the conclusions deduced from the interpretations of the activation curves. (tr-auth)

4040

CROSS SECTION OF THE $I^{127}(\gamma,n)I^{126}$ REACTION. J. Ero and L. Keszthelyi (Central Research Inst. for Physics, Budapest). Nuclear Phys. 2, 371-81(1956) Dec.

A NaI(Tl) scintillation crystal was irradiated with the gamma radiation of the $Li(p,\gamma)$ reaction. From the number of scintillations during the irradiation, and from the activity of the I^{126} isotope after the irradiation, the cross section of the $I^{127}(\gamma,n)I^{126}$ reaction was determined. The measurements give $\sigma(\gamma,n) = 125 \pm 6$ mb. Combining this with the results of other measurements in which neutrons were counted, the value $\sigma(\gamma,2n) = 30 \pm 20$ mb for the $I^{127}(\gamma,2n)I^{125}$ reaction was obtained. The ratio of the K capture of the I^{126} isotope to the total number of disintegrations has also been determined. It was found to be 0.51 ± 0.03. (auth)

4041

THE POSSIBLE EXISTENCE OF ROTATIONAL LEVELS IN Al^{28}. Raymond K. Sheline (Univ. of Copenhagen, Denmark). Nuclear Phys. 2, 382-94(1956) Dec.

The nine lowest levels in Al^{28} are interpreted as belonging to 4 rotational bands which in turn arise from two nuclear configurations. Experimental evidence from the beta decay of Mg^{28} and from the (d,p) stripping reaction on Al^{27}, including the spins, parities and energies of levels, the calculated moments of inertia of the bands, and the relative intensities of the beta and gamma transitions, is shown to be in excellent agreement with the interpretation. The nuclear configurations are shown to be consistent with experimental evidence and to arise naturally from the S. G. Nilsson levels for deformed nuclei. General trends in deformation in the low A region are discussed. A comparison is made between the moments of inertia of even-even, odd mass, odd-odd nuclei, and the corresponding calculated rigid moments of inertia. (auth)

4042

THE GAMMA SPECTRUM OF Sb^{124}. B. S. Dzhelepov, N. N. Zhukovsky, V. G. Nedovesov, I. F. Uchevatkin, and V. G. Chumin (V. G. Khlopin Radium Inst. of the USSR Academy of Sciences, Leningrad). Nuclear Phys. 2, 408-19 (1956) Dec.

A new determination of the gamma spectrum of Sb^{124} is described. The results, including the relative intensities of the lines, are summarized. (auth)

4043

SHELL EFFECTS IN NUCLEAR COULOMB ENERGY DIFFERENCES. O. Kofoed-Hansen (Univ. of Copenhagen). Nuclear Phys. 2, 441-9(1956) Dec.

In this discussion, the classical formula for nuclear Coulomb energies is abandoned and the Coulomb energies are instead calculated, using simple nuclear models. In agreement with empirical findings, the calculated curves show definite effects of nuclear shell structure. The evaluation of the nuclear radius (defined as $R = [5/3 \langle r^2 \rangle_{Av}]^{\frac{1}{2}}$) from the data shows that for medium heavy nuclei ($20 < A < 40$) $R = r_0 A^{\frac{1}{3}} = 1.24 A^{\frac{1}{3}}$, whereas for the very light nuclei r_0 becomes somewhat larger. (auth)

4044

ELECTRON g VALUE IN THE GROUND STATE OF DEUTERIUM. J. S. Geiger, V. W. Hughes, and H. E. Radford (Yale Univ., New Haven, Conn.). Phys. Rev. 105, 183-8 (1957) Jan. 1.

The ratio of the electron g_J in the deuterium ground state to the proton g_p in a cylindrical mineral oil sample has been measured. The measurement was made using the microwave magnetic resonance absorption method and apparatus which Beringer and Heald used to determine $-g_J/g_p$ for hydrogen. The three strong-field Zeeman transitions having $\Delta m_J = \pm 1$, $\Delta m_I = 0$ were observed at a frequency of 9200 Mc/sec. The accuracy was limited by the minimum observed line widths of 20 parts per million resulting principally from magnetic field inhomogeneities. When one uses the Breit-Rabi formula, the unweighted mean of 68 observations yields $-g_J(D)/g_p = 658.2162$ with an assigned error of ± 0.0008. The ratio of this value to the value of $-g_J(H)/g_p$ obtained by Beringer and Heald, who used an identical min-

eral oil sample is $g_J(D)/g_J(H) = 0.9999983 \pm 0.0000015$, and to the value of $-g_J(H)/g_p$ of Koenig, Prodell, and Kusch, after suitable diamagnetic corrections, is $g_J(D)/g_J(H) = 0.9999997 \pm 0.0000023$. These values are in agreement with the theoretically expected value of $g_J(D)/g_J(H) = 1$ and with the less precise direct measurement of Nelson and Nafe. (auth)

4045

ROTATIONAL STATES IN Tm^{171}. Sven A. E. Johansson (Univ. of Lund, Sweden). Phys. Rev. 105, 189-92(1957) Jan. 1.

The decay of Er^{171} has been investigated by means of a coincidence scintillation spectrometer. Eight gamma rays have been arranged in a level scheme with levels at 5, 118, 130, 337, and 425 kev. Spin and parity values have been assigned to most of levels. It is found that the first four levels form a rotational band in good agreement with the theoretical formula for the Case $K = \frac{1}{2}$. The beta-ray spectrum has been resolved in components which fit very well into the level scheme. The beta- and gamma-ray transition probabilities are discussed. They are found to be in good agreement with the theory. (auth)

4046

TOTAL NEUTRON CROSS SECTIONS OF Be, C, F, Co, AND Ge. R. O. Bondelid, K. L. Dunning, and F. L. Talbott (Naval Research Lab., Washington). Phys. Rev. 105, 193-6(1957) Jan. 1.

Neutrons in the energy range 3.8 to 8.1 Mev were used to determine the total neutron cross sections of Be, C, F, Co, and Ge. Transmission measurements were made in steps of 100 kev with a neutron energy spread of 100 kev. The present data are compared with previous results. (auth)

4047

NEUTRON RESONANCES IN THE KEV REGION: HEAVIER ODD ELEMENTS. H. W. Newson, J. H. Gibbons, H. Marshak, R. M. Williamson, R. C. Mobley, J. R. Patterson, and P. F. Nichols (Duke Univ., Durham, N. C.). Phys. Rev. 105, 198-201(1957) Jan. 1.

The neutron total cross sections have been measured as functions of energy for thallium (0.1 to 80), yttrium (6 to 80), rubidium (5 to 25), copper (1 to 80), and chlorine (6 to 200); peaks are observed which appear to be due to single resonances. The energy range of the measurements in kev is indicated in parentheses. Lanthanum (1 to 10) and yttrium (0.5 to 10) show peaks which may be due to single resonances. Lanthanum (10 to 100), praseodymium (0.5 to 150), gallium (1 to 60), gold (1 to 40), tantalum (1 to 6), silver (2.5 to 11), niobium (0.5 to 10.5), cesium (1 to 4.5), and iodine (1 to 15) show flat or wavy cross-section curves which are typical of spectra so poorly resolved that no single resonances are observed. Our failure to observe even the strongest single resonance in any of these elements is consistent with a roughly exponential distribution of reduced widths. Useful averaged cross sections are tabulated for some of the latter elements. (auth)

4048

DIFFERENTIAL CROSS SECTION MEASUREMENTS FOR THE ELASTIC SCATTERING OF PROTONS BY N^{14}. C. R. Bolmgren, G. D. Freier, J. G. Likely, and K. F. Famularo (Univ. of Minnesota, Minneapolis). Phys. Rev. 105, 210-12 (1957) Jan. 1.

The differential cross section for the elastic scattering of protons by N^{14} has been measured in the energy range from 1.5 to 3.5 Mev at scattering angles of 39°14′, 54°44′, 90°, 125°16′, and 140°46′ in the center-of-mass coordinate system. The probable error in the values of the cross section is about 4 to 5%. Pronounced anomalies in the cross section occur at laboratory proton energies of 1.55, 1.74, 1.805, 2.36, 2.49, 3.20, and 3.40 Mev, with a probable error in these energies of 0.01 Mev. The anomaly at 3.40 Mev indicates a previously unreported level in O^{15*} at about 10.5 Mev. The magnitude of the off-resonance cross section at 140°46′ is about four times, at 125°16′ about three times, and at 90° about two times that which would result from pure Rutherford scattering. At 54°44′ the off-resonance cross section differs from the Rutherford cross section over most of the energy range by less than 5%, while at 39°14′ the cross section is generally 10 to 20% below the Rutherford cross section. (auth)

4049

ELECTRON-NEUTRINO ANGULAR CORRELATION IN THE BETA DECAY OF NEON-19. Myron L. Good and Eugene J. Lauer (Univ. of California, Berkeley). Phys. Rev. 105, 213-16(1957) Jan. 1.

The distribution in kinetic energy of the recoil ions associated with beta rays of known energy in the beta decay of Ne^{19} has been measured. For the coefficient λ in the theoretical distribution in the cosine of the angle between the outgoing electron and neutrino, $[1 + \lambda(v/c)\cos\theta]$, we find a value of $\lambda = +0.14 \pm 0.13$, suggesting that the Fermi component of the beta decay interaction is scalar. (auth)

4050

THERMAL-NEUTRON COHERENT SCATTERING AMPLITUDES OF THALLIUM AND OSMIUM. LeRoy Heaton and S. S. Sidhu (Argonne National Laboratory, Lemont, Ill.). Phys. Rev. 105, 216-18(1957) Jan. 1.

4051

ELASTIC SCATTERING OF PROTONS BY N^{14}. F. B. Hagedorn, F. S. Mozer, T. S. Webb, W. A. Fowler, and C. C. Lauritsen (California Inst. of Tech., Pasadena). Phys. Rev. 105, 219-26(1957) Jan. 1.

The cross section for the elastic scattering of protons by N^{14} has been measured at center-of-mass angles of 90°, 125°, 154°, and 160° for proton energies between 620 and 1820 kev. Anomalies were observed at 1054 ± 3, 1544 ± 6, 1737 ± 4, and 1799 ± 5 kev. If one assumes that the nonresonant cross section results from only s-wave potential scattering, the assignments $J = \frac{3}{2}^+$ at 1054 kev and $J = \frac{1}{2}^+$ at 1544 kev are deduced. Fitting of the 1737-kev anomaly has not been found possible if one assumes a pure s-wave background. This uncertainty in background also prevents a definitive analysis of the 1799-kev data. However, qualitative theoretical fits of the 1799-kev data are obtained for p-wave formation of either a $J = \frac{1}{2}^-$ or $\frac{3}{2}^-$ state. (auth)

4052

LIFETIME OF THE FIRST EXCITED STATE OF B^{10}. S. D. Bloom, C. M. Turner, and D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 232-4(1957) Jan. 1.

The mean lifetime of the first excited state of B^{10} was measured at 0.72 Mev as 1.05 ± 0.10 mμsec by bombarding B^{10} with pulsed beams of 3-Mev protons and studying the delayed emission of gamma rays. This figure is a little longer than that given by earlier measurements of the E2 lifetime using recoil methods. The result is compared with preliminary shell model calculations and it is concluded that it is probably inconsistent with those calculations, at least if one restricts oneself to the value of the intermediate coupling parameter that gives good agreement with the experimental level scheme. It seems that some collective motion must be envisaged even in so light a nucleus as B^{10}. (auth)

4053

ATTENUATION OF Am^{241} $\alpha-\gamma$ ANGULAR CORRELATION IN LIQUID FILM SOURCES. V. E. Krohn, T. B. Novey, and S. Raboy (Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 234-7(1957) Jan. 1.

Measurements of the alpha-gamma correlation of Am^{241}

have been carried out for liquid sources. Attenuation of the angular correlation pattern with time was measured and λ_2 was determined for HCl, H_2SO_4, and $HClO_4$ media. For HCl and $HClO_4$ $\lambda_2 = 13.5 \pm 2$ per μsec and for H_2SO_4 $\lambda_2 = 21 \pm 2$ per μsec. These attenuation constants were independent of the concentration. The extrapolated value of A_2 has been compared with a prediction based on the rotational model. (auth)

4054

COULOMB EXCITATION OF BROMINE AND RHENIUM. E. A. Wolicki, L. W. Fagg, and E. H. Geer (Naval Research Lab., Washington). Phys. Rev. 105, 238-40(1957) Jan. 1.

Separated isotopes of bromine and rhenium have been studied by means of Coulomb excitation with 2- to 4.2-Mev protons and alpha particles. Gamma rays were observed with a NaI crystal spectrometer at the following energies: Br^{79}, 219 kev; Br^{81}, 278 kev; Re^{185}, 126, 160, and 286 kev; Re^{187}, 135, 168, and 303 kev. Probable level schemes are given which are based on coincidence measurements and, in some cases, on excitation curves. The results from data on Ta^{181} taken in the course of this study are also included. The reduced transition probabilities for excitation of all relevant nuclear levels have been measured. In the case of Ta and the Re isotopes the cascade to crossover intensity ratio in the decay of the second excited state has also been measured. (auth)

4055

INTERNAL BREMSSTRAHLUNG FROM Pr^{143} AND Pm^{147}. N. Starfelt and J. Cederlund (Univ. of Lund, Sweden). Phys. Rev. 105, 241-6(1957) Jan. 1.

A NaI(Tl) scintillation spectrometer was used for the study of the spectral distribution of the internal bremsstrahlung from the beta emitters Pr^{143} ($E_{\beta max}$ = 922 kev) and Pm^{147} ($E_{\beta max}$ = 226 kev). Both the shape of the corrected experimental spectra and the total yield of internal bremsstrahlung measured per beta decay disagree with the original Knipp-Uhlenbeck theory and with the improved version of this theory, which takes into account the nuclear Coulomb field. For Pr^{143} the measured bremsstrahlung yield exceeds that of the Knipp-Uhlenbeck theory by factors of 1.58 (1.48) and 2.56 (1.50) at 50 and 500 kev, respectively. The numbers in parentheses refer to the Coulomb-corrected theory. The corresponding factors for Pm^{147} are 1.58 (1.37) and 6.1 (2.45) at 25 and 150 kev, respectively. (auth)

4056

STUDIES WITH SCINTILLATION COINCIDENCE SPECTROMETER: Cs^{134}. Girish Chandra (Tata Inst. of Fundamental Research, Bombay 1). Proc. Indian Acad. Sci. 44, 194-200 (1956) Oct.

The set-up of the slow-fast coincidence scintillation spectrometer is described. Gamma-gamma coincidences in Cs^{134} have been studied. The 604-kev γ transition is found to be in cascade with 460 ± 20, 555 ± 15, 794 ± 15 and 1349 ± 30 kev γ transitions. The 794-kev γ transition is found to be in cascade with 604 ± 10 and 555 ± 15 kev γ transitions. The results are consistent with the decay scheme of Cs^{134} proposed by Forster et al. (auth)

4057

GAMMA SPECTRUM OF Rh^{107}. C. A. Mallmann, S. Mayo, and S. J. Nassiff. Rev. mex. fis. 5, 185-92(1956) Oct. (In Spanish)

The gamma spectrum of Rh^{107} was measured with a NaI(Tl) crystal scintillator having a 9% resolution for the 662-kev γ ray from Cs^{137}. Gamma rays of the following energies and relative intensities: 305 ± 3 kev (100), 385 ± 5 kev (18 ± 2); 570 ± 5 kev (1.6 ± 0.5); 680 ± 5 kev (3 ± 0.5) were detected. Coincidence measurements show that the 305- and 385-kev rays are in cascade. (tr-auth)

4058

PROPERTIES OF ENERGY SURFACES OF HEAVY NUCLEI. N. N. Kolesnikov (Moscow State Univ.). Soviet Phys. JETP 3, 844-53(1957) Jan.

A detailed investigation is carried out of the properties of the energy surface of heavy nuclei for each of the four types of nuclear parity. Along with a more precise formulation of known empirical laws and parameters of the energy surface, it is shown that for given mass numbers A, the masses of the nuclei reach a minimum value for several different values of Z depending on the parity of Z. The curvature of the isobar parabolas does not depend on the parity of Z and is apparently several times larger for nuclei with even A. The character of the shell N = 126 and Z = 82 is made clear. The results are compared with the usual formulas for the binding energy. (auth)

4059

THE POLARIZATION-DIRECTION CORRELATION OF SUCCESSIVE GAMMA-RAY QUANTA FROM Co^{60} AND Na^{24}. I. V. Estulin, V. S. Popov, and F. E. Chukreev (Moscow State Univ.). Soviet Phys. JETP 3, 866-70(1957) Jan.

An apparatus for observing the correlation of polarization and directions of propagation of successive gamma-ray quanta is described. The polarization sensitivity of this apparatus was determined experimentally and measurements were carried out for gamma-ray quanta of Co^{60} and Na^{24}. The first two excited states of Ni^{60} and Mg^{24} are shown to have even parity. (auth)

4060

NUCLEAR DENSITY AND THE DISTRIBUTION OF ORBITAL ANGULAR MOMENTUM IN NUCLEI. B. K. Kerimov and A. V. Dzhavadov (Moscow State Univ.). Soviet Phys. JETP 3, 878-81(1957) Jan.

A connection is found between the state of a nucleus, which is characterized by the minimum energy and the distribution of the mean square orbital angular momentum of the nucleons in the nucleus. The number of particles in the nucleus for which nucleons in the *l*-state first appear has been determined. (auth)

4061

COULOMB EXCITATION OF NUCLEI BY HEAVY IONS. A. P. Grinberg and I. Kh. Lembert (Academy of Sciences, USSR). Soviet Phys. JETP 3, 962-4(1957) Jan.

Calculations are made of the cross sections for Coulomb excitation of nuclei by heavy ions. (B.J.H.)

4062

ELECTRON SPECTRA OF Pu^{239}, Pu^{240}, AND Pu^{241}. K. N. Shliagin. Soviet Phys. JETP 3, 663-7(1956) Dec.

Two plutonium samples, containing different amounts of Pu^{239}, Pu^{240}, and Pu^{241}, have been analyzed on a 180° magnetic β spectrometer. Using thin celluloid films and radioactive sources, spectra were taken in an energy range beginning at ≈ 1 kev. From the conversion lines it was possible to determine the following energies for γ-transitions in U^{235} and U^{236}: for U^{235}—3 (?), 12.5, 38.3, 50.8, 117 (?) kev and for U^{236}—44.6 kev. The Pu^{241} β spectrum has the allowed shape with end point E_0 = 20.8 kev. (auth)

4063

CHARACTERISTICS OF THE LEVELS OF NONSPHERICAL EVEN-EVEN NUCLEI. I. S. Shapiro (Moscow State Univ.). Soviet Phys. JETP 3, 779-81(1956) Dec.

4064

MAGNITUDE OF THE NUCLEAR SPIN-ORBIT INTERACTION. I. I. Levintov (Inst. of Chemical Physics, Academy of Sciences, USSR). Soviet Phys. JETP 3, 796-8(1956) Dec.

The relative values of the moduli V_2/V_1, the ratio of the central and of the spin-orbit potentials from all available data, are presented. The ratio can be obtained from polar-

ization data at high energies (100 to 300 Mev) and may be estimated for low energies from the function p(r), which is the density distribution of nucleons in the nucleus. (F.S.)

4065

MODIFICATION OF DOUBLE PROTON SCATTERING EXPERIMENTS. L. N. Rozentzveig (Inst. of Technical Physics, Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 3, 798-9(1956) Dec.

4066

ISOMERIC TRANSITION OF THE Sn^{117} NUCLEUS. S. M. Kalebin. Soviet Phys. JETP 3, 799-801(1956) Dec.

Radioactive tin was obtained and separated chemically from other radioactive elements. The γ spectrum, electron absorption curve, decay curve, and electron spectrum were studied. (F.S.)

4067

EXPERIMENTAL STUDY OF COULOMB EXCITATION OF NUCLEI BY NITROGEN IONS. D. G. Alkhazov, D. S. Andreev, A. P. Grinberg, and I. Kh. Lemberg (Academy of Sciences, USSR). Soviet Phys. JETP 3, 964-6(1957) Jan.

An experimental investigation was made of the Coulomb excitation of the nuclei of 21 elements by nitrogen ions. The nitrogen ions were accelerated in a cyclotron to 15.6 Mev. The targets were pressed into the bottom of an isolated metallic vessel which served as a Faraday cup. Resultant data are summarized in both graphical and tabular form. (B.J.H.)

4068

VARIATION OF THE BINDING ENERGIES OF NEUTRONS AND PROTONS IN HEAVY NUCLEI. H. K. Raut. Indian J. Phys. 30, 611-19(1956) Dec.

The binding energy of the last neutron and of the last proton for different (N−Z) values has been calculated from Hg^{202} to Fm^{255} from current mass data. The variation of binding energy has been studied and graphs have been plotted throughout this range. It has been observed from such studies that there are possibilities for the existence of magic numbers after 82 protons and 126 neutrons. (auth)

NUCLEAR REACTORS

4069 AERE-M/M-121

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

XENON POISONING IN THE LIQUID METAL FUELLED REACTOR AND HOMOGENEOUS AQUEOUS REACTOR. W. H. L. Porter. [1956]. 6p. (LMFP/P-4).

A brief examination is made of the magnitude of the Xe poisoning in the liquid metal fuelled reactor and the aqueous homogeneous reactor. It is concluded that the Xe poisoning is appreciable and if neither Xe nor I are removed will attain 6% during steady operation and over 2 200% 12 hours after shut down. (B.J.H.)

4070 AERE-N/R-133(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NUCLEAR CALCULATIONS FOR DANGER COEFFICIENTS IN GLEEP. C. N. Watson-Munro. [Dec. 11, 1946]. 9p.

4071 AERE-R/M-1

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

GRAPHITE–URANIUM LATTICE CALCULATIONS. J. F. Hill. July 21, 1950. Decl. Nov. 26, 1956. 5p.

Results of calculations on graphite–U lattices are tabulated. (B.J.H.)

4072 ANL-5647

Argonne National Lab., Lemont, Ill.

SUMMARY REPORT ON THE HAZARDS OF THE ARGONAUT REACTOR. D. H. Lennox and C. N. Kelber. Dec. 1956. 106p. Contract W-31-109-eng-38. $0.55(OTS).

Descriptions are given of the installation of an Argonaut Reactor at the DuPage site of the Argonne National Laboratory. The reactor is to be operated by trained members of the staff, assisted by other laboratory personnel, and by students at the International School of Nuclear Science and Engineering, as a facility for nuclear engineering training and research. The design anticipates use of an Argonaut reactor in universities and in other less specialized institutions. Therefore, safety is a prime design feature through choice of a self-limiting system. The present design is the result of theoretical work that has been supplemented and extended by a series of multiplication experiments on the proposed configuration. It is expected that minor design improvements will be suggested from time to time to utilize new opportunities for cost reduction and requests for specialized experimental facilities. Argonaut is a 10-kw (max.) thermal reactor moderated by water and reflected by graphite. Plate-type fuel elements are spaced with graphite wedges to form an annular core. The total fissionable material required is about 4 kg U^{235}. The experimentally determined void coefficient for the lattice is negative: -0.25% k per void per cent. The temperature coefficient is also negative: -10^{-4} k/C. Excess k is less than 0.75%. Rapid insertion of up to 4.75% k_{ex} possible only by deliberate circumvection of procedures, interlocks, trips, and controls, will result in automatic shutdown through a non-destructive BORAX-type process. This postulated situation will not result in over-exposure of personnel near the reactor or contamination of the immediate vicinity. Complete release of fission products contained within the fuel plates by some process not easily imagined would require an exclusion radius of 875 ft, assuming no building containment. This report does not consider internal multiplicative experiments which could be performed by reloading the internal reflector. Such experiments must be subject to a separate hazards review. (auth)

4073 ANL-JMW-45

Argonne National Lab., Lemont, Ill.

A PROPOSAL TO THE ATOMIC ENERGY COMMISSION FOR ARGONNE BOILING REACTOR EXPERIMENT. J. M. West, C. K. Soppet, S. A. Bernsen, W. S. Flinn, and C. F. Bullinger. May 1956. Decl. Sept. 24, 1956. 65p. Contract W-31-109-eng-38. $0.40(OTS).

A proposal is presented which describes a reactor facility called the Argonne Boiling Reactor Experiment and subsequently abbreviated to ARBOR. It is designed to supply the operational data necessary to evaluate and develop the boiling water reactor as an economic central station power producer. The system envisioned consists basically of a reactor core and pressure vessel, steam condensers, heat exchangers, pumps, and the necessary valves, controls, and auxiliaries to permit wide variability in operating conditions and measurements. The facility is designed to accommodate the operational parameters inherent in the direct cycle, indirect cycle and dual cycle boiling reactor systems; it is capable of dissipating a minimum of 200 mw of reactor power at 600 psi in each of the above cases. The reactor vessel is designed for an operating pressure of 2000 psi at 636F, is 9 ft in diameter and can accommodate a reactor core up to 6 ft in diameter and height. The forced circulation pumps are capable of handling 35,000 gpm with a net developed head of about 125 psi. Combination of the foregoing design parameters results in a reactor which can provide operational data on light and heavy water designs. The use of a fully enriched core will permit investigation of power densities up to exceeding 200 kw/liter with adequate representation of the

steam void coefficient of reactivity associated with larger slightly enriched cores. This allows for simultaneous nuclear, hydrodynamic, and thermal simulation of light water reactors ranging up to, and possibly exceeding, 1000 mw gross thermal capability. In the heavy water case the direct representation of larger reactors will be somewhat less than in the light water case, due to the difficulty of simulating the nuclear parameters of a larger D_2O core in the 9-ft diameter pressure vessel. However, it was decided that present design and fabrication problems associated with pressure vessels much in excess of 9 ft diam. would far outweigh the somewhat improved performance of the D_2O reactor. It is planned to locate the facility at the National Reactor Testing Station to reduce costs associated with containment and hazards in a less remote location; it is also felt that a more ambitious testing program can be carried out at this site as demonstrated by both the Borax and SPERT operations. The proposed facility can be constructed in two years at a cost of $6,875,000, if authorization and funds are made available promptly. No deliberate sacrifices are contemplated insofar as adequacy of design for the intended purpose is concerned; but the remote location, the temporary nature of the facility, and the fact that no power utilization is involved, all tend to make the project relatively inexpensive. With the boiling test reactor (ARBOR) it will be possible to cover essentially the entire range of pertinent operating variables in a time period and for a capital investment comparable to that for a single small-scale prototype power plant. (auth)

4074 APEX-270

[General Electric Co.] Aircraft Nuclear Propulsion Project, [Cincinnati].

THE TWO AND THREE GROUP NEUTRON DIFFUSION THEORIES AS USED BY GE–ANPP. G. G. Leeth, E. D. Nix, and Fritz W. Mezger. July 9, 1952. Decl. July 5, 1956. 38p. (DC-52-2-32). $6.30(ph OTS); $3.00(mf OTS)

A discussion is given of how to set up two and three group neutron diffusion equations with parameters evaluated from IBM and Fermi age calculations. Solutions of the group equations are given for various geometries. A "two and one half group" diffusion model is also introduced as having application in certain types of calculation. (B.J.H.)

4075 ASAE-4

American Radiator and Standard Sanitary Corp. Atomic Energy Div., Redwood City, Calif.

A MULTIGROUP, MULTIREGION, ONE-SPACE DIMENSIONAL PROGRAM USING NEUTRON DIFFUSION THEORY. Joel Franklin and Edward J. Leshan. Dec. 1956. 27p. Contract [AT(04-3)-109]. $4.80(ph OTS); $2.70 (mf OTS).

DMM is a program using multigroup diffusion theory to calculate the reactivity or critical conditions and flux distribution of a multiregion reactor. As an essential part of this program are calculations of perpendicular buckling, fission produced xenon, and time variation due to production and depletion of isotopes. The adjoint fluxes may also be computed and the program includes the calculation of the nuclear constants from fairly simple input combined with a library of cross sections. DMM is presently being coded for the Datatron, the Remington Rand 1103A, and the IBM 704. (auth)

4076 BMI-ACRS-601(Rev.)

Battelle Memorial Inst., Columbus, Ohio.

HAZARDS SUMMARY REPORT FOR THE BATTELLE RESEARCH REACTOR. J. W. Chastain, R. F. Redmond, A. Klickman, J. Anno, and S. L. Fawcett. Apr. 4, 1955. 71p. $0.40(OTS).

The proposed reactor is a modified "swimming-pool" reactor and will operate at 1000 kw. At this power, it will provide fluxes of fast and slow neutrons and γ rays sufficient for a variety of experimental applications. After much study, a reactor incorporating an experimental stall attached to a large pool was designed. The reactor can be operated in the stall into which the beam tubes and thermal column converge. The reactor can be operated also in the open pool for shielding studies and large-scale irradiations. The plans for this facility and for the instrumentation, shielding, and controls are described in the report. The research reactor facility will be located 13 miles west of Columbus on a 400-acre tract owned by Battelle. The building will be constructed of masonry and Q-metal siding and will be devoted exclusively to the reactor. The minimum distance to the exclusion fence is about 1200 ft; an uninhabited swamp is on the other side of the fence at this point. The only buildings within 2000 feet are structures housing the Battelle critical-assembly facility and the hot-cell laboratories. The off-site area is farming country and is very sparsely settled. Only 60 permanent residents live within a one-mile radius. Discussions on the make-up of the surrounding area, including climatology, geology, hydrology, seismology, and the distribution of population and industry, are included. In the appendixes the reports from the sources (i.e., U. S. Geological Survey, U. S. Weather Bureau, etc.) are given. The conclusions in all cases are favorable to the site. Discussions are given on the operating procedure, the fuel inventory required, which is 5103 grams, and the time schedule, which suggests February 15, 1956, as a target date for initial criticality. The last two sections of the report are devoted to hazards during normal operation and hazards following an accident. During normal operation, cracking of the shield, inadequate shielding, and fissure of a fuel element could be hazardous. These and the ventilation and disposal systems are considered along with the methods for removing the associated dangers. Two reactor accidents and their hazards are considered: (1) a "maximum credible accident" in which an instantaneous increase in reactivity causes a power pulse and a Borax-type excursion, and (2) a "maximum hypothetical accident" in which there is complete vaporization of the fuel elements into a cloud. In the latter, which is the most extreme, direct radiation, inhalation, and fall-out of the radioactive cloud are considered. The results of these considerations indicate that, even in this hypothetical accident, the exclusion area is large enough to reduce the hazards to the general public to manageable proportions. It is concluded that the design is safe and that the location provides an adequate exclusion area. (auth)

4077 BWR-3(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DENSITY CHANGE AND PRESSURE DROP IN BOILING REACTOR. R. Clough. Oct. 4, 1954. Decl. with deletions Oct. 26, 1956. 12p.

Density variation along the coolant tube, mean density in the tube, over-all density in the core and tube pressure drop have been found for various annulus widths and water velocities. An over-all fluid density in the core of up to about 38 lb/ft^3 or 0.6 relative density could be obtained without much difficulty. A moderate increase in tube pitch (say about 15%) would enable a satisfactory water to uranium ratio to be obtained without going to very high circulation rates. It is possible that the pumping power would be considerably less than for LEO. (auth)

4078 CF-50-2-143

[Oak Ridge National Lab., Tenn.]

ADDENDA MEMORANDUM NO. 2 TO MTR GRAPHITE

REFLECTOR REPORT. F. C. Zapp. Feb. 20, 1950. Decl. Jan. 2, 1957. 10p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Contains corrections and additions for CF-49-10-88 and CF-49-11-176.

Design features of the MTR graphite support structure are outlined. Modifications to the graphite pebble bed support structure are briefly discussed. (B.J.H.)

4079 CF-54-4-62
Oak Ridge National Lab., Tenn.
ACTIVITIES OF FISSION PRODUCTS FROM CORE SOLUTION OF K-23 REACTOR. E. D. Arnold. Apr. 6, 1954. Decl. Feb. 8, 1956. 30p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Calculations have been made to determine the residual activities to be expected from irradiated core solution from the two-region homogeneous thermal breeder. Tables and graphs have been included to enable calculation of individual fission product activity in both curies and energy. Graphs have also been made to indicate the total activities from all non-gaseous fission products with half lives over $2\frac{1}{2}$ days. These plots indicate the total activity as a function of irradiation and cooling time for U^{233} at a flux of 3.2×10^{14} and a fission cross-section of 505 barns. Correction to any other desired condition can easily be made. A plot of total energy per curie of activity was also made which indicates that for short irradiation times the short half life fission products predominate as would be expected, and that the energy per disintegration is much higher for these early buildup products than for those that build up much slower. The Borst-Wheeler data, both tabular and in graphical form, were included for the purpose of indicating total heat activity of all fission products over the full cooling range. The values given in the Borst-Wheeler data are high by a factor of 1.5 to 2 and thus allow calculations of heat production to be on the safe side. An empirical equation describing buildup and decay of the major fission products has been determined. (auth)

4080 CF-54-8-235
Oak Ridge School of Reactor Technology, Tenn.
GAS COOLED CERAMIC POWER BREEDER REACTOR; REACTOR DESIGN AND FEASIBILITY PROBLEM. J. F. Smith, Jr., E. B. Ash, J. C. Deddens, F. B. Fairbanks, D. R. Gilfillan, B. W. LeTourneau, J. L. Mitchell, and F. H. Neill. Aug. 1954. Decl. Jan. 2, 1957. 220p. $1.35 (OTS).

A design study is made of a central station nuclear power plant utilizing a compact, direct closed cycle gas turbine system with He as the working fluid. The system is designed for a net electrical power output of 60 Mw. A terminal efficiency of 40% can be achieved with the closed gas cycle operating at 1000 psi pressure and 1400°F turbine inlet temperature, requiring a heat output of 150 Mw from the reactor. The reactor is designed within a pressure shell of 11 feet $\frac{1}{2}$ inch maximum outside diameter. The core contains uranium and thorium silicides in silicon carbide–silicon plate type fuel elements mounted in a graphite moderator. The active core is a right circular cylinder 6.5 ft in diameter by 6.1 ft in length. A breeding blanket, 1.5 ft thick, made up of ThO_2 blocks surrounds the core. An initial loading of 40 kg of U^{233} is planned, for an average thermal neutron flux of 1.65×10^{14} n/cm^2 sec at 25% burnup. The conversion ratio is 1.087 initially and 0.927 at the end of the 73-day full power operating cycle. Means are provided to minimize contamination of the system due to fission product leakage. The major problem to be solved appears to be the chemical processing of the fuel elements. The power cost from the system is estimated to be 7.6 mills/Kwh which compares favorably with other immediately practicable nuclear power systems of this size. (auth)

4081 CF-54-9-178
Oak Ridge National Lab., Tenn.
FLUID FLOW IN HRT PRESSURIZER. B. A. Hannaford. Sept. 24, 1954. Changed from OFFICIAL USE ONLY Dec. 7, 1956. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Several pressurizer piping arrangements were tested to determine their gas collection, mixing, and solid deposition characteristics. (D.E.B.)

4082 CF-54-12-146
Oak Ridge National Lab., Tenn.
HRT HAZARDS REPORT, CHEMICAL PROCESSING SYSTEM. H. O. Weeren. Dec. 10, 1954. Changed from OFFICIAL USE ONLY Dec. 7, 1956. 8p. Contract [W-7405-Eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The mishaps which are most likely to occur during the operation of the HRT fuel processing system are listed. The probable results of each mishap are investigated, and steps are recommended for eliminating the possibility of a hazardous occurrence. (D.E.B.)

4083 CF-55-1-166
Oak Ridge National Lab., Tenn.
HRE EXPERIMENTS ON INTERNAL RECOMBINATION OF GAS WITH A HOMOGENEOUS CATALYST. S. Visner and P. N. Haubenreich. Jan. 21, 1955. Decl. May 8, 1956. 49p. Contract [W-7405-eng-26]. $0.45(OTS).

The use of Cu, dissolved in the fuel solution, for complete recombination of radiolytic gases is successfully demonstrated in the HRE. The investigation was conducted at temperatures from 185 to 260°C, pressures from 765 to 1200 psig, and power levels up to 1600 kw. At the highest $CuSO_4$ concentration (0.06 molar) no deleterious effects were observed. (T.R.H.)

4084 CF-55-2-4
Oak Ridge National Lab., Tenn.
FEASIBILITY STUDY: USE OF ODOROUS WARNING AGENTS IN RADIO-CLOUDS. E. D. Arnold and A. T. Gresky. Feb. 1, 1955. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

4085 CF-55-6-69
Oak Ridge National Lab., Tenn.
RESTRICTING FLOW OF SOLUTION FROM REACTOR TO CHEMICAL PROCESSING CELL IN THE EVENT OF A MAJOR BREAK IN PROCESS PIPING. H. O. Weeren. June 3, 1955. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

4086 CF-55-8-174
Oak Ridge National Lab., Tenn.
HRT CHEMICAL FACILITY CARRIER SHIELDING CALCULATIONS. H. E. Williamson. Aug. 30, 1955. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

4087 CF-55-9-113
Oak Ridge National Lab., Tenn.
HRT-CP: EVALUATION OF THERMAL INSULATION AND HIGH PRESSURE FLANGES FOR HRT CHEMICAL PROCESSING. W. L. Carter and A. M. Rom. Sept. 20, 1955. Changed from OFFICIAL USE ONLY Dec. 21, 1956. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

4088 CF-57-1-50
Oak Ridge National Lab., [Y-12 Area], Tenn.
EXAMINATION OF HRT "O" RING GASKETS FROM

FLANGES A-117 AND D-127. MET. SPEC. NOS. X12760 AND X12761. Metallography Report (Y-12) No. 40. T. M. Kegley, Jr. Jan. 14, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The results of an examination of "O" ring gaskets removed from the HRT following a discovery that the water in the leak detector system contained 1000 ppm chloride are presented. (W.L.H.)

4089 CF-57-1-90

Oak Ridge National Lab., Tenn.

HIGH PRESSURE RECOMBINATION LOOP PROGRESS REPORT. P. H. Harley. Jan. 4, 1957. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The operation and design of a high pressure recombination loop for the recombination of H_2, D_2, and O_2 produced by the radiolytic decomposition of water which is used as a solvent for fuel in the homogeneous reactors are presented. (W.L.H.)

4090 HW-43922

Hanford Atomic Products Operation, Richland, Wash.

THE REACTIVITY VALUE OF HIGHLY BURNED PLUTONIUM IN THERMAL REACTORS. R. E. Heineman and H. W. Lefevre. June 25, 1956. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Isotopic concentrations, reactivity values, and thermal reproduction factors are plotted for 0 to 9 years at 5×10^{13} $n\text{-}cm^{-2}sec^{-1}$. (D.E.B.)

4091 KAPL-M-RWD-17

Knolls Atomic Power Lab., Schenectady, N. Y.

NUCLEAR EVALUATION OF SLAB-TYPE CONTROL RODS. R. W. Deutsch. Dec. 19, 1956. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

In order to introduce the epithermal control rod effects for a slab geometry, a two-group method analagous to the one-group method, which has been used for the absorption area method, is developed. The two-group method in conjunction with experimental measurements permits the determination of epithermal cross sections for individual rods as well as the determination of the rod worth of a group of rods. A semi-quantitative analysis of FPR and ATR experiments is in agreement with the theory. (auth)

4092 KAPL-M-SMS-55

Knolls Atomic Power Lab., Schenectady, N. Y.

TOTAL GAS AND HYDROGEN MEASUREMENT EQUIPMENT FOR S3G/S4G. Test Report. F. C. Steiner. Jan. 21, 1957. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Tests which were carried out in support of the design of the S3G/S4G coolant sampling system with regard to the determination of the total gas and hydrogen concentration in the primary coolant are summarized. The results indicate that the measurement of the total gas concentration by a modified Orsat equipment and the determination of the percentage of hydrogen by means of a Cambridge Analyzer, Model 120-H, provides a suitable method of determining the concentration of hydrogen in the primary coolant over the range of 15 to 50 cc H_2/kg. The results obtained by this method are generally in good agreement with those obtained by chemical laboratory techniques involving complete degasification of a water sample and analysis for hydrogen by means of the combustion tube of the Orsat and by mass spectrometer. It was also established that a 500 cc sample bomb provides a sufficient gas volume to determine the hydrogen concentration over the range of 15 to 50 cc/kg with an accuracy of about ±3 cc/kg. (auth)

4093 LA-1159(Del.)

Los Alamos Scientific Lab., N. Mex.

ORALLOY HYDRIDE CRITICAL ASSEMBLIES. H. C. Paxton, J. D. Orndoff, and G. A. Linenberger. May 22, 1950. Decl. with deletions Jan. 24, 1957. 61p. Contract W-7405-eng-36. $10.80(ph OTS); $3.90(mf OTS).

Critical-mass determinations for pseudospheres of oralloy hydride composition (approximating UH_3) in 8 in.-thick Tu and Ni tampers and in the Tu tamper with Ni liner were made. The critical mass of a hydride cube in the thick Tu also is given. Data on weight and dimensional changes of hydride pieces during the period of use are included. The results of Rossi time-scale measurements on the hydride assemblies are presented. Values of alpha at delayed critical and its variation with mass in the neighborhood of delayed critical are given. Measurements on the activation of various detectors within the hydride assemblies are described. Results as a function of radial position are given for Au, for Au shielded by Au and by Cd, for S and for fission catchers with U^{235} and U^{238}. Reactivity changes resulting from the introduction of foreign materials into the hydride assemblies are discussed. Apparent regularities with respect to Z and qualitative interpretations of variations with radius are pointed out. From data for various radial positions, changes in critical mass corresponding to small changes in composition and density are computed. (auth)

4094 NAA-SR-116(Del.)

North American Aviation, Inc., Downey, Calif.

ON THE HAZARD DUE TO NUCLEAR REACTORS. M. M. Mills. Oct. 1950. Decl. with deletions Dec. 28, 1956. 24p. $4.80(ph OTS); $2.70(mf OTS).

A major hazard associated with any nuclear reactor is the possible contamination of the atmosphere or water supply by the accidental release of the radioactive materials contained within the core. This problem can be considered in two stages: the technological sequence of events leading to the hazardous release of radioactive materials from the reactor, and the distribution of this radioactivity by meteorological and hydrological mechanisms. The possible mechanisms of reactor catastrophe are mechanical disruption, cooling failure, and reactor runaway. Sabotage seems to be the most probable cause of mechanical disruption. On the basis of the theoretical studies which have been carried out, cooling failure and reactor runaway seem to lead to the same type of behavior. This is the gradual, nonexplosive release of volatilized substances containing radioactive products, and the quantity so released is usually small enough to be contained within an adequately sealed building. Some experimental studies are needed to substantiate these theoretical conclusions. It appears likely that for the reactors which have been built or are presently contemplated an adequately gas-tight reactor building can remove the public hazard. The absence of mechanical shock, external to the shield, makes this possible. Some development in building construction may be needed to attain this goal. Studies, both theoretical and experimental, leading to intrinsically safe designs would be very desirable. The possibility of building a reactor which is intrinsically safe because of a large negative transient temperature coefficient is demonstrated with an example. (auth)

4095 NAA-SR-1760

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SODIUM GRAPHITE REACTOR QUARTERLY PROGRESS REPORT [FOR] JULY–SEPTEMBER 1956. L. E. Glasgow, ed. Jan. 15, 1957. 61p. Contract AT(04-3)-49. $0.40(OTS).

Studies were made of various alternate core configurations for the SRE. Determinations were made of SRE power and temperature coefficients of reactivity. Lattice code computations given an over-all temperature coeffi-

cient of reactivity of $+9 \times 10^{-5}$/°C at 200°C. Schematic diagrams are given of the dynamic cold-trapped Na loop (NaZrI) and of the hot-trapped loop (NaZrII). The weight gain for samples of technical reactor grade Zr exposed to cold-trapped Na was further investigated. The effects of surface oxide, dissolved H_2, and grain size on the fatigue life of Zr test specimens are shown graphically. Tensile tests of SRE Zr exposed to Na were performed at 500 and 985°F and results are tabulated. The dimensional stability of moderator can Zr under thermal cycling was rechecked. An analog analysis was made of the SRE main airblast heat exchanger. Figures are given to show some of the representative severe transients that were run on the analog computer. Progress on reactor construction is briefly described. Tests to determine the ability of Stellite No. 3 and Stellite No. 6 to withstand reactor operating temperatures were continued. Tests on the safety rod prototype are also summarized. Calculations were made to determine the γ-ray dose rates at SRE instrument tubes A summary of data for Na centrifugal pumps is given. Pump washing experiments were conducted to ascertain the problems involved in cleaning centrifugal pumps after service in a Na system. (For preceding period see NAA-SR-1690.) (B.J.H.)

4096 NAA-SR-1782

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A HIGH-PRESSURE $B^{10}F_3$ LOADING SYSTEM FOR A REACTOR SAFETY ELEMENT. Charles R. F. Smith. Feb. 1, 1957. 17p. Contract AT(11-1)-GEN-8. $0.20 (OTS).

A reactor safety device utilizing $B^{10}F_3$ pressure-filled elements has been developed. In connection with this program, a system was designed for loading production-lot quantities of the elements with this gas. The flow diagram for the system is described starting with production of the gas from $CaF_2 \cdot B^{10}F_3$ powder. The gas is purified by fractionation, then accumulated in a low-pressure reservoir and finally pressurized to 5200 psi by condensation-vaporization prior to charging. High-pressure chambers are filled with $B^{10}F_3$ at 2400 psi, then sealed by a crimp-braze technique. This system is capable of loading 5.5 grams of $B^{10}F_3$ per hour, which is equivalent to filling two 3-cc chambers per hour at a gas density of 0.9 g per cc. (auth)

4097 NURG-M-6

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE USE OF ENRICHED URANIUM IN A POWER REACTOR. J. F. Hill. May 25, 1951. Decl. Nov. 26, 1956. 2p.

The amounts of 2:1 enriched uranium required in a 150 Mw reactor were found for various values of the core radius. These values are tabulated. (B.J.H.)

4098 ORNL-2240

Oak Ridge National Lab., Tenn.

THE OAK RIDGE NATIONAL LABORATORY RESEARCH REACTOR (ORR): A GENERAL DESCRIPTION. T. E. Cole and J. P. Gill. Feb. 8, 1957. 63p. Contract W-7405-eng-26. $0.40(OTS).

The proposed ORNL Research Reactor is designed to serve as a general purpose research tool delivering an average thermal neutron flux of 1.3×10^{14} n/cm^2-sec at the initial power level of twenty megawatts. Operation at power levels up to thirty megawatts is proposed for such times as sufficient cooling capacity is available to handle the increased heat load. The reactor will use MTR type fuel elements and Be reflector pieces in a 7 × 9 grid with moderation and cooling provided by forced circulation of demineralized water. The reactor tank is submerged in a pool filled with water with walls and bottom of barytes concrete which serves as a biological shield. Experimental facilities include two engineering test facilities approximately 19 in. × 25 in. and six 6 in. diameter beam holes. In addition, access to the core is available through the water of the pool. (auth)

4099 WAPD-T-88

Westinghouse Electric Corp. [Bettis Plant], Pittsburgh.

STUDY-BY SIMULATOR TECHNIQUES-OF TRANSIENT PRESSURES IN HIGH PRESSURE WATER SYSTEMS UTILIZING A SURGE TANK. W. M. Gajewski. Sept. 6, 1955. 20p. $0.20(OTS).

The responses of a surge tank (pressurizer) were computed for the following design parameters: steam volume, power changes, rates of power change, normal spray rates of flow, temperatures of normal spray flow, surge spray rates (function of surge rate), and surge spray temperature. Results indicate that sprays reduce magnitude of surge pressure. (C.W.H.)

4100 WAPD-T-432

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

EXPERIMENTAL TECHNIQUES FOR THE CALIBRATION OF REACTOR CONTROL DEVICES AND FOR THE DETERMINATION OF POWER LEVEL (thesis). Stanley Kaplan. Nov. 1956. 36p. Contract [AT-11-1-GEN-14]. $6.30(ph OTS); $3.00(mf OTS).

Submitted to Univ. of Pittsburgh.

Neutron absorption and production processes in reactors are discussed. Expressions are developed which indicate the significance of these processes in reactor control and power studies. Methods of control rod calibration and power level determination are reviewed. (D.E.B.)

4101 WAPD-TH-131

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

COBRA INSTRUMENTATION MIXING TESTS. J. R. Parrette and R. E. Grimble. Sept. 9, 1955. Changed from OFFICIAL USE ONLY Nov. 1, 1956. 5p. $1.80 (ph OTS); $1.80(mf OTS).

A series of dye mixing tests were made to evaluate outlet stream thermocouple readings for the Cobra subassembly. The tests were made on two geometrical arrangements at three flow rates each. (B.J.H.)

4102 WAPD-TM-28

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

WANDA—A ONE-DIMENSIONAL FEW GROUP DIFFUSION EQUATION CODE FOR THE IBM-704. Orville J. Marlowe, Carl P. Saalbach, Linwood M. Culpepper, and Dorothy S. McCarty. Nov. 1956. 38p. Contract AT-11-1-GEN-14. $0 30(OTS).

4103

MEASUREMENTS ON A SUBCRITICAL REACTOR USING A PULSED NEUTRON SOURCE. Nils Göran Sjöstrand. Arkiv Fysik 11, 233-46(1956).

A pulsed neutron source was introduced into the Swedish heavy-water reactor R1 when it was in a subcritical state. The time behavior of the neutron density was studied by means of a multichannel time analyzer. Using this technique the time constant of the prompt neutrons and the reactivity was determined at several heavy water levels down to about 20 cm below the critical level. It was found that the reactivity equivalent of the heavy water is $(7.2 \pm 0.1) \times 10^{-5}$ per mm, and that the mean lifetime of the thermal neutrons in the reactor is 0.68 ± 0.02 msec. These values refer to the critical level and are based on a fraction of delayed and photo neutrons amounting to 0.78×10^{-2}. A calibration of the safety rods gave the result that each of them corresponds to a reactivity of 1.7 ± 0.2 per cent and both together to 3.4 ± 0.4 per cent. (auth)

4104
DETERMINATION OF THE CRITICAL VOLUME OF A SPHERICAL REACTOR. Gerard Bouquet, Francis Leschino, Marc Feix, Rene Loutfoullah, Paul Nicourd and Aime Sestier. Compt. rend. 244, 165-8(1957) Jan. 7. (In French)

An attempt is made to solve the integral equation giving the critical conditions of a sphere of fissile material surrounded by a reflector. A matrix method using the passage from shell to shell is used. The theory is explained within the framework of one group of neutrons but it can easily be applied to more groups. As an example, a study is made of the rapidity of convergence. (tr-auth)

4105
ON THE PROBLEM OF OVERSHOOTS IN THE CONTROL OF NUCLEAR REACTORS. J. U. Koppel and H. Schultz. J. Nuclear Energy 3, 312-20(1956) Nov.

The time-dependent behavior of two reactors, one uncontrolled and the other controlled by means of a specified automatic control system, are analyzed and compared. Conditions are established to rule out overshoots over the final stationary values of power and temperature, and upper limits of the overshoots are calculated when these conditions are not satisfied. Some attention is given to the influence of the delayed neutrons. (auth)

4106
INSTRUMENTATION AND CONTROLS FOR HRT. D. S. Toomb, Jr. (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 2, 48-52(1957) Feb.

A description is given of the control system of the HRT. Individual components, particularly several temperature, level, and pressure transmitters, are described in detail. (T.R.H.)

4107
DETERMINING COOLANT FLOW IN SRE FUEL ELEMENTS. W. J. Freede and T. T. Shimazaki (North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 15, No. 2, 64-7(1957) Feb.

Following CCl_4-weighted sawdust photographically and $MnCl_2$ chemically in water as mock-up coolant, the flow pattern was determined for SRE fuel elements. Results show that coolant mixing is adequate for cooling fuel rods. (auth)

4108
MODIFYING CP-5 FOR 4-Mw OPERATION. W. H. McCorkle (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 2, 91-2(1957) Feb.

4109
FUEL ELEMENTS FOR NUCLEAR REACTORS. J. B. Anderson (Combustion Engineering, Inc., New York). Trans. Am. Soc. Mech. Eng. 79, 29-33(1957) Jan.

A general discussion is presented of the basic requirements for fuel elements for nuclear reactors and of the heat-transfer characteristics affecting the selection of a fuel element design. This is followed by a presentation of typical fuel elements along with a discussion of their potential performance and applicability in line with the basic requirements and heat-transfer factors discussed earlier. (auth)

4110
SAFEGUARD FEATURES OF A FAST-BREEDER-REACTOR POWER PLANT. W. J. McCarthy, Jr. (Atomic Power Development Associates, Inc., Detroit) and F. C. McMath (The Detroit Edison Co., Mich.). Trans. Am. Soc. Mech. Eng. 79, 41-6(1957) Jan.

In the design of a reactor power plant, special attention to safety is required in order to safeguard the investment in the plant and to insure that danger to the public is reduced to negligible proportions. Some design features relevant to the safety of a fast-breeder-reactor power plant are described. The decision to enclose the radioactive portions of the plant in a gastight building to provide a final barrier between the reactor and the public is discussed. Criteria developed for locating the reactor on a safe and economically suitable site are presented. (auth)

4111
METHODS OF REFUELING HETEROGENEOUS NUCLEAR REACTORS. Stuart McLain, A. H. Barnes, and R. C. Goertz (Argonne National Lab., Lemont, Ill.). Trans. Am. Soc. Mech. Eng. 79, 47-53(1957) Jan.

The problems involved in refueling heterogeneous nuclear reactors are discussed briefly. The various procedures which have been developed to date are described and the actual steps in reloading various types of reactors are outlined. (auth)

4112
PROGRESS IN NUCLEAR ENERGY. SERIES II. REACTORS. R. A. Charpie, D. J. Hughes, D. J. Littler, and M. Trocheris, eds. New York, McGraw-Hill Book Co., Inc., 1956. 501p.

A complete descriptive review is given of the research reactors in Canada, the U. S., Russia, Europe, and the United Kingdom. In the discussion of Canadian reactors, particular emphasis is placed on the NRX Reactor. The NRU and ZEEP reactors are described more briefly. The basic design principles, descriptions of actual and planned reactors, and important operating characteristics of MTR-type, heavy water, and water boiler research reactors in the U. S. are outlined. Descriptions of the nuclear reactor (a uranium graphite reactor), a heavy water research reactor, a reactor used as a neutron source and for testing fuel elements, a water-enriched U reactor, and the reactor in the first atomic power station. Descriptions are given of the five operating research reactors in Europe. Discussions are included on experience in the use of a compressed gas as a heat transfer agent, a study of neutron distributions in the 2 French heavy water reactors, measurements of the resonance integral of U, and materials testing by the oscillation method. All of the U. K. research reactors are described and some of the results of experimental work performed on them are given. The series of reactors under construction is also described. A complete technical description is given of the Pressurized Water Reactor Power Plant at Shippingport, Penna., with emphasis being placed on its engineering aspects as affected by nuclear considerations. Results of preliminary tests on a non-nuclear mockup of the core are included. The design and operating experience of a prototype boiling water power reactor are also discussed. The use of the aqueous homogeneous reactor as a source of economical nuclear power is discussed. Other topics which are discussed include the graphite-moderated, gas-cooled reactor as a power producer, the Na-cooled graphite reactor, and a review of fast power reactors. A catalogue of the world's nuclear reactors is also included. The salient features of each reactor are given with an extensive list of references. (B.J.H)

Refer also to abstracts 3646, 3788, 3818, 4183, and 4213.

NUCLEAR TRANSFORMATION

4113 NYO-3864
Johns Hopkins Univ., Baltimore.
MEASUREMENTS ON THE $Be^9(n,2n)Be^8$ REACTION.
J. M. Fowler, G. E. Owen, and S. S. Hanna. Oct. 1954. 74p. Contract AT(30-1)-1251. $7.80(ph OTS); $3.30(mf OTS).

The $Be^9(n,2n)Be^8$ reaction has been studied at a neutron energy of 3.7 Mev using the $D(d,n)He^3$ reaction as a neutron source. The inelastic neutrons were observed with two large trans-stilbene scintillation counters operated in coincidence, and the neutron flux was monitored with the protons from the $D(d,p)H^3$ reaction. The pulse height spectrum from one of the counters was measured with a multichannel analyzer which was gated by coincidences between the pulses from the two counters. In order to establish the relation of pulse height to proton energy in the energy region below 1 Mev, the response of stilbene and anthracene to incident protons and x rays was investigated and the results were compared with predictions of the theory proposed by Birks. The two neutrons from beryllium were observed in a plane containing the incident neutron at the following pairs of angles: 30°-30°, 60°-60°, 67°-67°, 80°-80°, 90°-0°, and 0°-90°. These spectra showed evidence of two discrete neutron groups, suggesting the mechanism $Be^9(n,n')Be^{9*}(n'')Be^8$. The total cross sections were calculated at each of the angular settings with the assumption of an isotropic distribution, and the values varied between 0.30 and 0.50 barns. Within the accuracy of the experiment there was no substantial evidence of a correlation with the incident neutron or between the two neutrons. (auth)

4114 UCRL-3394

California. Univ., Berkeley. Radiation Lab.

ABSOLUTE CROSS SECTIONS FOR SECONDARY PARTICLES PRODUCED IN HIGH-ENERGY NUCLEAR BOMBARDMENTS. L. Evan Bailey. Apr. 20, 1956. 8p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

Absolute cross sections for the production of charged secondary particles in the bombardments of Al, Ni, Ag, and Au by 332-Mev protons, 187-Mev deuterons, and 380-Mev α particles have been determined. The relative yields of various secondaries from these bombardments were previously reported by Deutsch. Secondaries were produced in thin ribbon targets, were detected in nuclear track plates placed inside the 184-inch synchrocylotron, and were identified through measurement of their curvature in the cyclotron's magnetic field and of their range in nuclear emulsion. To determine absolute yields the targets were monitored for residual β and γ activity. These activities were compared with the target activities arising from a known flux of primaries; this flux was determined in a calibration experiment performed in the external cyclotron beam. (auth)

4115 UCRL-3426

California. Univ., Berkeley. Radiation Lab.

PRODUCTION OF NEUTRAL PHOTOPIONS AS A FUNCTION OF ATOMIC WEIGHT (thesis). John David Anderson. May 28, 1956. 40p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

The relative yield of neutral pions from various elements in the reaction (γ,π^0) has been determined as a function of the quantum-limit energy (the maximum energy of the quanta in the bremsstrahlung beam) of the Berkeley synchrotron. Single decay gammas from neutral pions were observed at 135° to the incident photon beam in the laboratory system. The yield of neutral pions is assumed proportional to A^b, where b is determined from a least-squares fit to the data. Interpreting the results in terms of an optical model without scattering corrections, one obtains values for the mean free path for absorption of the neutral pions in nuclear matter. These values are tabulated. (auth)

4116 UCRL-4303(Del.)

California. Univ., Livermore. Radiation Lab.

HIGH ENERGY FISSION AND SPALLATION OF URANIUM. Roger E. Batzel. Feb. 25, 1954. Decl. with deletions Jan. 29, 1957. 19p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

An attempt has been made to examine, semiquantitatively, the way the competition between neutron emission and fission varies for heavy nuclei as a function of nuclear type and excitation energy. On the basis of the measured cross sections for fission induced by 3 to 6 Mev neutrons, the ratio of the probability of neutron emission to fission was found to be an exponential function of Z^2/A, and using this dependence of fissionability and neutron emission on nuclear type, the data of Lindner and Osborne from their studies of the 340 Mev proton-induced spallation of U were examined. It was found that an assumption of the constancy of the ratio of neutron emission and fission probabilities as a function of increasing excitation energy fits the available information on the total inelastic cross section for U reasonably well. (auth)

4117 UCRL-Trans-192(L)

DETECTION OF POLARIZATION OF (d,d)-NEUTRONS THROUGH SCATTERING ON CARBON. E. Baumgartner and P. Huber. Translated by S. Shewchuck from Helv. Phys. Acta 26, 545-62(1953). 25p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA-7-6232.

4118

THE RATIO OF DEUTERONS TO PROTONS IN PHOTONUCLEAR REACTIONS DETERMINED BY THE METHOD OF GRAIN-COUNTING. Bengt Forkman. Arkiv Fysik 11, 265-75(1956).

An investigation has been made into the usefulness of the grain-counting method for identification of short tracks. Efforts have been made to separate deuterons from protons by grain-counting in the last 40 μ of the track. The protons and deuterons were obtained by photodisintegration of metals by bremsstrahlung of 30 Mev maximum energy. At the same time the photodeuteron yield has been compared with the photoproton yield from cobalt and copper. No marked difference in the ratio, $Y(\gamma, d)/Y(\gamma,p)$, was obtained. The ratio observed was 0.22 for cobalt and 0.16 for copper. (auth)

4119

MEASUREMENTS OF THE EFFECTIVE CROSS SECTION FOR THE $Li^6(n,t)He^4$ REACTION IN THE NEUTRON ENERGY RANGE OF 9 TO 700 KEV. G. V. Gorlov, B. M. Gokhberg, V. M. Morozov, and G. A. Otroshchenko. Doklady Akad. Nauk S.S.S.R. 111, 791-4(1956) Dec. 1. (In Russian)

Monoenergetic neutrons in the above energy range were obtained from the $T(p,n)He^3$ reaction. Measurements of the absolute value for the effective cross section of the $Li^6(n,t)He^4$ reaction at 265 kev (maximum cross section) and the correlation of the effective cross sections to the neutron energies up to 700 kev confirmed the previously published data indicating the prevailing role of the p-interaction in formation of the intermediate nucleus Li^7 in its excited state during the $Li^6(n,t)He^4$ reaction. (R.V.J.)

4120

THE (γ,n) REACTION IN Be^9 AT INTERMEDIATE ENERGIES. R. D. Edge (Australian National Univ., Canberra). Nuclear Phys. 2, 485-95(1956) Dec.

Cross sections for the reaction $Be^9(\gamma,n)Be^8$ for monochromatic γ rays in the energy range 2.6 to 8.1 Mev have been obtained using a large Szilard-Chalmers neutron detector. At energies of 2.61, 4.4, 6.2, and 8.1 Mev they are $(3.77 \pm 0.2) \times 10^{-28}$ cm^2, $(1.86 \pm 3.6) \times 10^{-28}$ cm^2, $(11.4 \pm 1.0) \times 10^{-28}$ cm^2 and $(13.8 \pm 1.6) \times 10^{-28}$ cm^2 respectively. The implications of these results for current theories of the reaction are discussed. (auth)

4121

STUDY OF THE TRANSMUTATION OF COPPER BY NI-

TROGEN AND OXYGEN. J. Beydon, R. Chaminade, M. Crut, H. Faraggi, J. Olkowsky and A. Papineau. Nuclear Phys. 2, 593-618(1957) Jan. (In French)

The transmutations of Cu bombarded by N and O ions are studied, both for natural Cu and for the separated isotopes Cu^{63} and Cu^{65}. The results are summarized. Most reactions take place through fusion of the colliding nuclei. New γ-rays: Se^{72}, 50 kev, T ≈ 10 d; Br^{75}, 285 ± 5 kev, T ≈ 95 ± 5 min; Br^{74}, 640 ± 10 kev, T ≈ 42 ± 5 min. New isotope: Rb^{79}, β^+ emitter, T = 24 ± 1 min, at least one γ-ray of 150 kev. (auth)

4122

TRANSMUTATION OF COPPER BY CARBON, OXYGEN, AND NEON. H. Atterling, J. Beydon, M. Crut, and J. Olkowsky. Nuclear Phys. 2, 619-23(1957) Jan. (In French)

Transmutations of Cu bombarded by C, O, and Ne ions are studied. The results are summarized. Most reactions take place through fusion of the colliding nuclei. (auth)

4123

COMPARISON OF THE REACTIONS Co^{59} + Ne^{20} AND Cu^{63} + O^{16}. M. Crut, H. Faraggi, J. Olkowsky, and H. Atterling. Nuclear Phys. 2, 624-33(1957) Jan. (In French)

A comparison of the actions Co^{59} + Ne^{20} and Cu^{63} + O^{16} shows that they take place mainly through the formation of the same compound nucleus Rb^{79}. The production of Ga^{67}, however, is different in the two cases and must therefore be due in part to some other process. (auth)

4124

RADIATIVE PROTON CAPTURE BY C^{13}. H. B. Willard, J. K. Bair, H. O. Cohn, and J. D. Kington (Oak Ridge National Lab., Tenn). Phys. Rev. 105, 202-4(1957) Jan. 1.

A new resonance in the yield of the $C^{13}(p,\gamma)N^{14}$ reaction has been observed at E_p = 3.11 ± 0.01 Mev with a total width of 30 ± 3 kev and a peak cross section of 0.70 ± 0.14 millibarn for the ground state transition. An assignment of 2^- has been made for this 10.43-Mev level in N^{14} which results from the capture of d-wave protons and decays mainly by electric dipole radiation to the ground state. This result is inferred from the observed angular correlation of $W(\theta)$ = $1-(0.40 \pm 0.02)P_2(\cos\theta)$ and the large radiation width of 17 ev. It is most probably a T = 1 state. There is about a 10% cascade through the 6.44-Mev level of N^{14}. (auth)

4125

NEW NUCLEAR REACTIONS INDUCED BY 2-MEV LITHIUM IONS; THE MASSES OF B^{13} AND C^{15}. E. Norbeck, Jr. (Univ. of Chicago, Ill.). Phys. Rev. 105, 204-9(1957) Jan. 1.

A lithium ion source has been developed which can be used in a standard 2-Mev van de Graaff generator, producing a focussed beam of 1 to 2 microamperes of magnetically separated Li^7. Above 1.4 Mev the beam produced disintegration particles from lithium targets, and above 1.8 Mev disintegrations from beryllium were observed. The reaction $Li^7(Li^7,p)B^{13}$ was studied by observing the protons at 90° from the lithium beam. The Q value is 5.97 ± 0.05 Mev and the M−A of B^{13} is 20.39 ± 0.05 Mev, corresponding to a physical atomic weight of 13.02190 ± 0.00005. The cross section for the ejection of B^{13} protons into unit solid angle at 90° rises monotonically and exponentially from 1.2 to 22 microbarns between 1.4 and 2.0-Mev bombarding energy. Three groups of protons from the reaction $Li^6(Li^7,p)B^{12}$ were identified, and the two of lesser energy corresponded well with the known excited states of B^{12} at 0.950 and 1.67 Mev. The intensities of the proton groups at 2 Mev were ground: first excited: second excited = 1:1.1:0.8. Two groups of protons were identified from the reaction $Be^9(Li^7,p)C^{15}$. The more energetic of these established the Q value of the reaction as 9.05 ± 0.05 Mev, and corresponds to an M−A of C^{15} of 14.35 ± 0.05 Mev, or a physical atomic weight of 15.01541 ± 0.00005. The proton group of lesser energy is 2.1 times as intense as the ground state group at 2-Mev bombarding energy and at 90° from the beam; it corresponds to an excited state of the C^{15} nucleus lying 0.70 ± 0.05 Mev above the ground state. (auth)

4126

THE RELATION BETWEEN STRIPPING AND COMPOUND NUCLEUS FORMATION IN DEUTERON REACTIONS. Iu. A. Nemilov, K. I. Zherebetsova and B. L. Funshtein (Radium Inst., Academy of Sciences, USSR). Soviet Phys. JETP 3, 732-5(1956) Dec.

An estimate is made of the relative probability for stripping and compound nucleus formation in the Mg^{26} (d,p) Mg^{27} reaction, by comparing the yields of final nuclei formed as a result of d,p and d,α processes on Mg^{26}, and by n,p and n,α processes on Al^{27}. It is found that the ratio of the stripping cross section to the cross section for compound nucleus formation varies with deuteron energy and reaches a maximum value of 8 to 9 for deuteron energy 1 to 2 Mev. (auth)

4127

NUCLEAR LEVELS IN Li^6. Iu. L. Sokolov, M. M. Sulkovskaia, E. I. Karpushkina and E. A. Albitskaia. Soviet Phys. JETP 3, 740-4(1956) Dec.

With the aid of the photographic detection method, reactions with emergence of several particles were studied, which arise as a result of interaction of fast deuterons (with energies up to 13.8 Mev) with nuclei of Li^6 and Li^7. The following reactions were detected: Li^6 (d,2d) He^4, Li^6 (d,d',p, n) He^4 and Li^7 (d,t,d') He^4, which lead to the formation of excited Li^6 nuclei. The following levels of the Li^6 nucleus were found (with T = 0): E_1^* = 2.2 Mev, E_2^* ≈ 4.5 Mev and E_3^* ≈ 7.5 Mev. (auth)

4128

(γ,p) REACTIONS ASSOCIATED WITH THE FORMATION OF GROUND STATE NUCLEI. V. I. Gol'danskii (P. N. Lebedev Inst. of Physics, Academy of Sciences, USSR). Soviet Phys. JETP 3, 791-2(1956) Dec.

The contribution of the individual levels to photonuclear (γ,p) reactions, which can be obtained from experimental data regarding the cross sections of reverse (p,γ) reactions that take place without cascade emission of γ rays, was determined. (F.S.)

4129

SPECTRA OF NEUTRONS PRODUCED BY BOMBARDING LIGHT NUCLEI WITH 14 MEV DEUTERONS. G. F. Bogdanov, N. A. Vlasov, S. P. Kalinin, B. V. Rybakov and V. A. Sidorov. Soviet Phys. JETP 3, 793-5(1956) Dec.

4130

YIELDS OF PHOTONEUTRONS FROM INTERMEDIATE AND HEAVY NUCLEI. B. I. Gavrilov and L. E. Lazareva (Academy of Sciences, USSR). Soviet Phys. JETP 3, 871-7 (1957) Jan.

The yields of photoneutrons were measured for various maximum γ-bremsstrahlung energies lying between the threshold of the (γ,n) reactions up to E_{max} = 27 Mev. The photoneutron cross section was determined by the "photon difference method" as a function of the photon energy from the yield curves for ten elements (copper, zinc, cadmium, iodine, tantalum, gold, thallium, bismuth, thorium and uranium). (auth)

4131

PRODUCTION OF NUCLEAR STARS BY γ-QUANTA. Iu. A. Vdovin. Soviet Phys. JETP 3, 948-50(1957) Jan.

An investigation is made of the mechanism of the production of nuclear stars by γ quanta in which the γ quantum creates a virtual π-meson pair at a large distance from the nucleus and this pair is in turn absorbed by the nucleus producing a star. The cross section for such a reaction is found using the matrix element of the radiative transition. (B.J.H.)

4132
ON THE NUCLEAR REACTION Be^9 (p,d) Be^8. T. I. Kopaleishvili (Tiflis State Univ.). Soviet Phys. JETP 3, 973-4(1957) Jan.

The Be^9 nucleus is regarded as consisting of a Be^8 core with an unpaired neutron moving in its field. On the basis of this model, the Be^9(p,d) Be^8 reaction is considered to be the result of the direct interaction of a proton and the unpaired neutron. Cross sections for the reaction are derived and compared with experimental values. (B.J.H.)

4133
DISINTEGRATION OF BERYLLIUM AND CARBON NUCLEI AS A RESULT OF π^--MESON CAPTURE. A. A. Varfolomeev and R. I. Gerasimova (Academy of Sciences, USSR). Soviet Phys. JETP 3, 988-9(1957) Jan.

In order to study the disintegration of C and Be nuclei on stopping π^- mesons, powdered C and Be were introduced into a nuclear emulsion. The emulsion was then exposed to a beam of slow π^- mesons in a synchrocyclotron. Data on pion absorption events are tabulated. (B.J.H.)

4134
GAMMA RESONANCES IN REACTIONS OF PROTON CAPTURE BY SILICON ISOTOPES. S. P. Tsytko and Iu. P. Antuf'ev (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 3, 993-4(1957) Jan.

The integral excitation function of the Si(p,γ)P reaction was measured on a 4-Mev electrostatic generator in the proton energy interval from 500 to 2600 kev. A thick target was prepared from a pure single crystal of Si. The observed γ resonances are listed. (B.J.H.)

Refer also to abstract 4197.

PARTICLE ACCELERATORS

4135 AERE-GP/R-1246
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ELECTROSTATIC FOCUSING DEVICE FOR USE WITH THE HARWELL F. M. CYCLOTRON. A. O. Edmunds and F. Uridge. Sept. 2, 1953. 11p.

An electrostatic focusing device for use with the Harwell cyclotron is described. For 146-Mev protons the focal length of the unit is approximately 2.8 meters, using a maximum electrode voltage of 60 kv relative to ground. A gain factor of over 40 has been obtained giving a flux of 2.5×10^7 protons/cm^2/sec at a point 13 meters from the cyclotron. At the working point the beam has a square cross-section of 2 cm × 2 cm. (auth)

4136 UCRL-1137(Del.)
California. Univ., Berkeley. Radiation Lab.
MTA QUARTERLY PROGRESS REPORT [FOR] SEPTEMBER, OCTOBER AND NOVEMBER 1950. Feb. 16, 1951. Decl. with deletions Dec. 4, 1956. 81p. Contract W-7405-eng-48. $15.30(ph OTS); $5.40(mf OTS).

Progress is reported on the design and development of the Materials Testing Accelerator and its components. Discussions are included on such topics as electron model tests, drift tube model magnet tests, model cavity tests, linear accelerator electron loading, r-f equipment, power supplies, ion injectors, and target programs. (B.J.H.)

4137
REGENERATIVE ACTION IN HIGH ENERGY ACCELERATORS. Stanley Cohen and Albert V. Crewe (The Univ. of Chicago, Ill.). Nuclear Instr. 1, 31-40(1957) Jan.

It is shown that the regenerative method for the extraction of particles from an accelerator can be extended to include machines other than cyclotrons. This is accomplished by the use of modes of radial oscillations in which the regenerative action does not occur on every revolution of the particle about the machine. In particular, that mode of oscillation which allows regenerative action on every other turn is analyzed and shown to permit extraction from circular machines whose values of n ($n = -(R/H)(dH/dr)$) lie near 0.75. An extension of the analysis to machines with straight sections and strong focusing machines is included. (auth)

4138
DIVERGING ELECTROSTATIC LENSES IN ACCELERATORS. E. Breitenberger (Univ. of Malaya, Singapore 10). Nuclear Instr. 1, 55(1957) Jan.

The characteristics of diverging electrostatic lenses for particle accelerators where the ions emerge through a narrow canal in a plate into an accelerating column are reviewed. (F.S.)

4139
ACHROMATIC BEAM TRANSLATION SYSTEMS FOR LINEAR ACCELERATORS. K. L. Brown (Stanford Univ., Calif.). Rev. Sci. Instr. 27, 959-63(1956) Nov.

The beam of electron linear accelerators has desirable geometric properties, but usually contains undesirable secondary particles and a relatively broad energy spectrum. In order to dispose of the secondary particles and, at the same time, establish control of the width of the energy spectrum, several magnetic deflection systems have been considered for the Stanford machines. Two such systems are described here, one of which has been adopted for three of the Stanford accelerators. Both systems are capable of translating the beam without energy dispersion. (auth)

4140
LINEAR THEORY OF BETATRON OSCILLATIONS IN SECTORIAL CYCLOTRONS. Lee C. Teng (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 1051-8(1956) Dec.

In a sectorial cyclotron the "force functions" and the frequencies of the linearized normal and axial betatron oscillations are given as power series in the inverse-square of the number of sectors. The coefficients in these series are expressed either in terms of parameters characterizing the magnetic field or in terms of those specifying the family of equilibrium orbits. The first-order terms agree with those in existing approximate expressions. Among other features of the higher order terms, they show that it is possible to design magnetic fields with momentum compactions varying over wide ranges and frequencies of betatron oscillations remaining constant. Together with a scheme proposed earlier of transferring ions continually between circular accelerators, this opens the possibility of accelerating ions continually in several stages of constant-frequency sectorial cyclotrons to multi-Bev energies. This method of analysis can also be applied to the study of nonlinear betatron oscillations. (auth)

4141
THE ROLE OF RADIATIONAL LOSSES IN CYCLIC ACCELERATORS. A. A. Kolomenskii and A. N. Lebedev (Academy of Sciences, USSR). Soviet Phys. JETP 3, 946-7(1957) Jan.

Some generalizations are made concerning the movement of relativistic electrons in cyclic accelerators. It is concluded that only the increase in mass due to acceleration influences the amplitude of the betatron oscillations. (B.J.H.)

4142
THE INFLUENCE OF THE PROXIMITY OF AN EXTERNAL RESONANCE ON THE MAGNITUDE OF THE TRANSITION ENERGY IN A STRONG FOCUSSING ACCELERATOR. Iu. F. Orlov. Soviet Phys. JETP 3, 950-2(1957) Jan.

4143
RADIATION RESONANCE IN SYNCHROTONS. A. N.

Matveev (Moscow State Univ.). Soviet Phys. JETP 3, 959-60(1957) Jan.

Remarks are made concerning a resonance which takes place under certain conditions in synchrotrons, due to the presence of radiation, which can amplify the amplitude of betatron oscillations. (B.J.H.)

RADIATION ABSORPTION AND SCATTERING

4144 NYO-7818

Rochester, N. Y. Univ.

POLARIZATION IN PROTON-PROTON SCATTERING AT 130, 170, AND 210 MEV. E. Baskir, E. M. Hafner, A. Roberts, and J. H. Tinlot. Dec. 28, 1956. 21p. Contract AT(30-1)-875. $4.80(ph OTS); $2.70(mf OTS).

Using a 90% polarized proton beam, polarization in p-p scattering was measured at center-of-mass angles between 20 and 81° at 130 Mev, between 31 and 82° at 170 Mev, and between 14 and 112° at 210 Mev. The first two of these measurements are consistent with data previously published; the third involves an energy in the neighborhood of which earlier detailed work has not been done. The measurements are fitted by functions of the form $P(\theta)\sigma(\theta) = \sin\theta\cos\theta \sum_{n=0}^{M} b_{2n}\cos^{2n}\theta$, where M = 0, 1, or 2. At 210 Mev, a three-parameter least squares fit yields $b_0 = (2.78 \pm 0.16)$, $b_2 = (-2.24 \pm 0.17)$, and $b_4 = (2.96 \pm 0.77)$ mb per ster. Statistical analysis of the data at 210 Mev indicates that F-wave effects, and in particular a non-vanishing b_4, are required for description of the scattering. (auth)

4145

POLARIZATION OF LOW ENERGY PROTONS SCATTERED BY CARBON. B. V. Gavrilovskiĭ, V. A. Golovnya et al. (Physico-Technical Inst. U.S.S.R. Acad. of Science). Doklady Akad. Nauk S.S.S.R. 111, 59-62(1956) Nov. 1. (In Russian)

Protons were scattered on solid carbon targets (C^{12}) to determine the relation of P(E). The azimuthal asymmetry of the second scattering was measured for protons in the primary beam at various energies. The results of the experiment agreed with the theoretical values calculated for proton polarization and indicated that during the scattering a strong proton polarization takes place in the energy range of 1.6 to 2.4 Mev. (R.V.J.)

4146

ON THE SCATTERING MATRIX OF AN INTERMEDIATE SYSTEM. M. S. Livshits (Odessa Hydrometeorological Inst.). Doklady Akad. Nauk S.S.S.R. 111, 67-70(1956) Nov. 1. (In Russian)

Mathematical derivations are developed for the noncoupled energy operator in the intermediate system formed in the process of two-particle elastic collision, with considerations for the relativistic mass-velocity relations of these particles. (R.V.J.)

4147

POLARIZATION OF PROTONS ELASTICALLY SCATTERED BY C^{12} NUCLEI. P. V. Sorokin and A. Ya Taranov (Physico-Technical Inst. of U.S.S.R. Acad. of Science). Doklady Akad. Nauk S.S.S.R. 111, 82-4(1956) Nov. 1. (In Russian)

Works on elastic scattering of protons by C^{12} nuclei based on phase analysis, previously reported in the literature, described the partial polarization of scattered protons and plotted the curves showing the relation of polarization P to the energy of protons at various angles of scattering. Experiments were carried out in an attempt to check the accuracy of the phase analysis method and the previously obtained results. (R.V.J.)

4148

ON DISPERSION RELATION FOR NUCLEON-NUCLEON SCATTERING. F. M. Kuni (Leningrad State Univ.). Doklady Akad. Nauk S.S.S.R. 111, 571-4(1956) Nov. 21. (In Russian)

Attempts were made to calculate the value $A(n,n)(\omega)$, which is the imaginary part of nucleon-nucleon scattering amplitude forward in the interval of $-m < \omega < m$ (where ω is the energy of the bombarding nucleon and m is the nucleonic mass) and for the case where spins of the scattering and scattered nucleons disperse in the opposite directions. The calculations were based on charge-symmetry theory with pseudoscalar coupling. (R.V.J.)

4149

AN INTERMEDIATE SYSTEM FORMED DURING THE SCATTERING OF ELEMENTARY PARTICLES. M. S. Livshits (Odessa Hydrometeorological Inst.). Doklady Akad. Nauk S.S.S.R. 111, 799-802(1956) Dec. 1. (In Russian)

An attempt was made to determine the properties of the intermediate system which formed during the collision of two elementary particles, with the assumption that the interaction between the particles is conditioned by the quasi-charge conjuncting the corresponding fields. (R.V.J.)

4150

NUCLEON-NUCLEON SCATTERING IN THE PRESENCE OF NONCENTRAL FORCES. I. NEUTRON-PROTON SCATTERING. M. Gourdin. J. phys. radium 17, 988-96 (1956) Dec. 1. (In French)

The study of neutron-proton scattering is made for a potential including a tensor force. An explicit calculation gives an expression for the effective differential scattering cross section expanded in Legendre polynomials. (tr-auth)

4151

BACKSCATTERING OF POSITRONS. Louis Danguy and Robert Quivy. J. phys. radium 17, 1021-2(1956) Dec. (In French)

An experimental study was made of the backscattering of positrons emitted by Na^{22} and Zn^{65} as a function of the thickness, the atomic number, and the specific weight of the scatterer. (B.J.H.)

4152

ENERGY LOSS AND STRAGGLING OF 150-MEV ELECTRONS IN Li, Be, C, AND Al. A. M. Hudson (Stanford Univ., Calif.). Phys. Rev. 105, 1-6(1957) Jan. 1.

The most probable energy loss and the straggling distribution for 150-Mev electrons in thin targets (~2.5 g/cm^2) of Li, Be, C, and Al have been measured utilizing the electron beam of the Stanford Mark III linear electron accelerator. The primary beam energy spectrum had a full width at half height of 0.20 Mev. The data for the most probable energy loss agree with the theory of Landau when corrected for the density effect according to Sternheimer. A recent recalculation of this density effect on the basis of new values for the mean excitation potentials after Caldwell noticeably improves agreement between theory and experiment for carbon. Comparison is made with previous calculations using Bakker and Segrè potentials. The half widths of the straggling distributions are between 7 and 15% wider than the Landau theory predicts, in qualitative agreement with a recent comment by Hines. (auth)

4153

EXPERIMENTS WITH 315-MEV POLARIZED PROTONS: PROTON-PROTON AND PROTON-NEUTRON SCATTERING. O. Chamberlain, E. Segre, R. D. Tripp, C. Wiegand, and T. Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 105, 288-301(1957) Jan. 1.

The polarization in elastic p-p and p-n scattering at 315 Mev has been measured as a function of the scattering angle. The maximum polarization observed in each of these interactions is approximately 40 percent. A similar measurement of the polarization in p-p scattering at 276 Mev is also reported. Triple-scattering experiments have been performed to measure the depolarization $D(\theta)$ and the rotation $R(\theta)$ in

the proton-proton interaction. These parameters have been measured for center-of-mass scattering angles ranging from 22 to 80 degrees. Expressions for the measured quantities in terms of 14-phase shifts of the proton-proton system for $J \leq 6$ and $l \leq 5$ are included. Two of the phase shifts represent mixing between states of the same total angular momentum J, spin S, and parity. Five sets of phase shifts are reported which satisfy 36 measurements of total cross section, relative differential cross section, polarization, depolarization, rotation, and supplementary conditions imposed by the analysis of information from the reaction $p + p \rightarrow \pi^+ + d$. (auth)

4154

PHASE-SHIFT ANALYSIS OF 310-MEV PROTON-PROTON SCATTERING EXPERIMENTS. H. P. Stapp and T. J. Ypsilantis (Univ. of California, Berkeley) and N. Metropolis (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 302-10(1957) Jan. 1.

The results of a phase-shift analysis of proton-proton cross-section, polarization, and triple-scattering experiments at ~310 Mev are reported. From an extensive search five satisfactory solutions have been found. Three additional solutions that give fair fits to the data are also reported. (auth)

4155

INELASTIC SCATTERING OF 0.3, 0.77, AND 1.0 MEV PHOTONEUTRONS. Kh. R. Poze and N. P. Glazkov. Soviet Phys. JETP 3, 745-51(1956) Dec.

Cross sections were measured for inelastic scattering of neutrons of three energies: 0.3, 0.77 and 1.0 Mev by the nuclei of 13 elements: uranium, bismuth, lead, mercury, tungsten, antimony, tin, cadmium, copper, nickel, iron, aluminum, and sodium. For heavy nonmagic nuclei (uranium, mercury and tungsten), the cross section for inelastic scattering of neutrons with energies 0.8 and 1 Mev was found to be 1 to 2 barns. For light and magic nuclei the cross section for these same neutrons was found to be small, of the order 0.1 to 0.2 barns. In addition, for incident neutrons with $E_0 = 1$ Mev, an estimate was made of the average energy of the inelastically scattered neutrons, and the energy levels excited were determined for some nuclei. (auth)

4156

THE SCATTERING OF PHOTONS BY NUCLEONS AND NUCLEAR ISOBARS. V. I. Ritus. Soviet Phys. JETP 3, 926-34(1957) Jan.

The scattering cross section for photons against nucleons is computed, taking into account absorption and the excited states of the nucleons (isobars). The excited states of the nucleons are described by a relativistic equation for particles of spin and isotopic spin $\frac{3}{2}$. The coupling constants were obtained by comparison of experiments on the scattering and photoproduction of mesons on protons. Comparison of the results of this calculation with experimental data on the scattering of photons by protons would provide an additional check on the admissibility of the isobaric representation and on the correctness of the values chosen for the constants. (auth)

4157

ON THE SCATTERING OF PHOTONS BY NUCLEONS. R. I. Gurzhi (Academy of Sciences, USSR). Soviet Phys. JETP 3, 941-5(1957) Jan.

The cross section for scattering of photons against nucleons is computed on the basis of a semiphenomcnological isobaric theory including absorption. (auth)

4158

POLARIZATION OF ELASTICALLY SCATTERED DEUTERONS. O. D. Cheishvilli (Tiflis State Univ.). Soviet Phys. JETP 3, 974-6(1957) Jan.

Calculations are given concerning the elastic scattering of polarized deuterons by nuclei with zero spin. (B.J.H.)

4159

MECHANICAL PHASE ANALYZERS FOR TREATMENT OF EXPERIMENTAL DATA ON THE SCATTERING OF PARTICLES WITHOUT SPIN ON PARTICLES WITH SPIN 0 OR 1/2 N. P. Klepikov (Academy of Sciences, USSR). Soviet Phys. JETP 3, 981-4(1957) Jan.

Refer also to abstracts 3980 and 4186.

RADIATION EFFECTS

4160 AECU-3391

[Sandia Corp., Albuquerque, N. Mex.]

GAMMA IRRADIATION OF COAXIAL CABLE AND MAGNETIC RECORDER TAPE. Osborne Milton. Aug. 18, 1955. 11p. (TM-192-55-16). $1.80(ph OTS); $1.80 (mf OTS).

Three electrical cables and selected lengths of magnetic recorder tape were exposed to the gamma radiation from freshly ejected fuel elements at the Materials Testing Reactor in Idaho. Some of the items were damaged as a result of the radiation. (auth)

4161 AECU-3392

Sandia Corp., Albuquerque, N. Mex.

THE EFFECTS OF THE RADIATIONS FROM NUCLEAR FISSION. Osborne Milton. Mar. 15, 1956. 34p. (TM-13-56-16). $6.30(ph OTS); $3.00(mf OTS).

The need for further knowledge of radiation damage to industrial material is discussed. A study is made of neutron, gamma, fission products, and beta damage to various metals and plastics. Reactors and test facilities are described, and supporting data evaluated. (auth)

4162 ANL-4642(Del.)

Argonne National Lab., Lemont, Ill.

CARBON 11 TRACER EXPERIMENTS ON THE FATE OF DISPLACED CARBON ATOMS IN GRAPHITE. G. R. Hennig and A. F. Kurs. June 29, 1951. Decl. with deletions Dec. 13, 1955. 25p. Contract W-31-109-eng-38. $0.25(OTS).

Radiation-damaged graphite containing radioactive displaced carbon (C^{11}) atoms has been prepared by cyclotron or betatron irradiation. The irradiated samples were annealed, and the distribution of radiocarbon was then determined by controlled combustion of the graphite. It was concluded that a considerable fraction, possibly all, of the recoil displaced atoms annealed to the discontinuities surrounding the perfect regions within the graphite particles. This annealing appeared to be complete at temperatures below 750°C. (auth)

4163 CC-2322(Del.)

[Chicago. Univ. Metallurgical Lab.].

CHEMICAL RESEARCH–RADIATION CHEMISTRY REPORT FOR MONTH ENDING OCTOBER 31, 1944. Nov. 11, 1944. Decl. Jan. 5, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).

4164 CF-56-6-32

Oak Ridge National Lab., Tenn.

RADIATION DAMAGE TO AQUEOUS THORIUM OXIDE SLURRIES. H. F. McDuffie and D. G. Thomas. June 4, 1956. Decl. Jan. 2, 1957. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The effect of reactor radiation on the electrical double layer of ThO_2 slurry particles and on the particles themselves is discussed. Proposed experiments to evaluate these effects are outlined. (T.R.H.)

4165 CRDC-653

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

IRRADIATIONS OF URANIUM TRIOXIDE–WATER SLURRIES IN THE NRX REACTOR. A. W. Boyd and J. L. Whitton. June 1956. 42p. (AECL-393).

Two natural UO_3-H_2O slurries (2.5 and 5.0 gm $UO_3 \cdot H_2O$/10 ml H_2O) were exposed in stainless steel autoclave at $\sim 6 \times 10^{12}$ neutrons/sec/cm^2 for 2 months and 3 months. Most of the oxide had changed to $UO_3O \cdot 8H_2O$. Little corrosion or water contamination occurred. For 100 ev of fission recoil particles in the slurry 0.9 molecules of water were decomposed, and the activation energy of recombination is 19 kcal/mol. (T.R.H.)

4166 IDO-16294

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR HOT CELL TESTS OF HIGH PRESSURE PIPING. M. S. Robinson, F. W. Rider, and M. H. Bartz. Dec. 5, 1956. 28p. Contract AT(10-1)-205. $0.25(OTS).

The KAPL-30 (formerly NRL-1) experiment consisted of a circulating water loop constructed of A-201-B carbon steel. This loop was operated in the MTR for 1299 Mwd at an MTR power level of 30 Mw and for 600 Mwd at a power level of 40 Mw. During operation the loop was maintained at a temperature of 600°F and a demineralized water pressure of 2200 psi. A primary objective of the experiment was to determine the feasibility of using carbon steel as a principle construction material in high temperature water cooled reactors. The thimble end of the loop was tested in the MTR hot cell to determine changes in physical properties resulting from irradiation. Tensile, hardness, and crush ring type samples were machined from the thimble and tested in the hot cell. Machining and testing procedures and equipment employed are outlined. Tensile tests indicated an increase in tensile strength of approximately 20% and the hardness at the thimble tip increased approximately 30%. (auth)

4167 KAPL-M-POS-1

Knolls Atomic Power Lab., Schenectady, N. Y.

ON THE TEMPERATURE DEPENDENCE ON THE LATTICE DEFECTS IN NEUTRON-IRRADIATED LITHIUM FLUORIDE. P. Senio and C. W. Tucker, Jr. Dec. 26, 1956. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

It is proposed that neutron-induced lattice defects produced in lithium fluoride are a type characteristic of the irradiation temperature. (auth)

4168

EFFECTS OF GAMMA IRRADIATION ON PHYSICAL PROPERTIES OF MINERALS. Manuel N. Bass (Princeton Univ., N. J.). Am. Mineralogist 42, 100-4(1957) Jan.–Feb.

Studies were made to determine the effects of γ radiation on the density and refractive index of halite, fluorite, quartz, epidote, allanite, muscovite, biotite, and lepidolite. (R.V.J.)

Refer also to abstract 4038.

RADIOACTIVITY

4169

THE STANDARDIZATION OF ELECTRON-CAPTURE ISOTOPES. R. A. Allen (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Intern. J. Appl. Radiation Isotopes 1, 289-98(1957) Jan.

4170

PRODUCTION OF Mg^{28} IN THE PILE AND CYCLOTRON AT HARWELL. C. E. Mellish and G. W. Crockford (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Intern. J. Appl. Radiation Isotopes 1, 299-304(1957) Jan.

Two methods of production of Mg^{28} are investigated. By bombardment in the reactor the t, p reaction on magnesium in an alloy of lithium and magnesium is used and the dependence of the cross-section on the lithium content is determined. In the cyclotron method the spallation of chlorine by proton bombardment is examined and the dependence on proton energy and target size is measured. (auth)

4171

ON THE DECAY OF W^{185}. Nadine Marty and Michel Vergnes. J. phys. radium 17, 1013-15(1956) Dec. (In French)

Tungsten^{185} disintegrates by emission of a β spectrum of maximum energy 425 ± 2 kev; the 57-kev ray is the Ta x ray due to the K capture in W^{181}. The continuous γ spectrum with a maximum near 120 kev is attributed to the internal and external bremsstrahlung accompanying the β decay of W^{185}. (tr-auth)

4172

STUDY OF RaD SOURCES WITH ILFORD E_1 PHOTOGRAPHIC EMULSIONS. Marie Ader and Marie-Paule Cabannes. J. phys. radium 17, 1023-4(1956) Dec. (In French)

4173

INVESTIGATION OF INTERNAL CONVERSION LINES IN THE β-SPECTRUM OF A MIXTURE OF Eu^{152} AND Eu^{154} ISOTOPES. V. M. Kelman, V. A. Romanov, R. Ya. Metskhvarishivili, and V. A. Kolyunov (Physico-Technical Inst. of the USSR Academy of Sciences, Leningrad). Nuclear Phys. 2, 395-407(1956) Dec.

A high resolution prism β spectrometer was employed to measure the K-shell and L- and M-subshell internal conversion lines of Sm^{152} and Gd^{154}. Internal conversion coefficient ratios for transition energies of 122 and 123.2 kev were also determined. Energy differences between the conversion lines were measured with a high degree of precision. (auth)

4174

INTERNAL CONVERSION COEFFICIENTS FOR M1 TRANSITIONS IN $_{83}Bi^{214}$, $_{84}Po^{214}$ AND $_{83}Bi^{212}$. K. O. Nielsen, O. B. Nielsen, and M. A. Waggoner (Inst. for Theoretical Physics, Copenhagen, Denmark). Nuclear Phys. 2, 476-84 (1956) Dec.

Measurements on internal conversion lines of Bi^{214} confirm that the experimental M1 internal conversion coefficients for heavy elements are considerably smaller than the values calculated for a point nucleus. The results are in approximate agreement with the finite size corrected values of Sliv and Band. A number of transitions in Po^{214} with $\Delta I = 0$ or 1 were found to be mainly M1 according to conversion coefficients corrected for finite size effects. The tables of uncorrected conversion coefficients would have indicated the systematic occurrence of large E2 admixtures. The K/L ratio for the 115-kev M1 transition in Bi^{212} was found to agree with the theoretical value, which is not sensitive to the finite size effect. This ratio was earlier thought to be abnormally low. (auth)

4175

OF DECAY Eu^{152} AND $Eu^{152\,m}$. O. Nathan and M. A. Waggoner (Univ. of Copenhagen, Denmark). Nuclear Phys. 2, 548-74(1957) Jan.

Using magnetic and scintillation spectrometers and coincidence techniques the radiations from pile-irradiated natural Eu were studied. The energies of a number of β- and γ-rays and internal conversion lines were measured and isotopic assignments were made from the coincidence data. The internal conversion coefficients of a number of the transitions are determined from measurements of the relative intensities of γ-rays and internal conversion lines.

Decay schemes are proposed for the two isomers of Eu^{152} and plausible spin and parity assignments for some of the excited states of Sm^{152} and Gd^{152} are presented. The difference in level structure between these two nuclei is discussed in the light of the Bohr-Mottelson unified model and it is suggested that some of the high-lying excited states may possibly be interpreted as collective vibrations of the electric quadrupole and electric octupole type. (auth)

4176

DISINTEGRATION OF Ga^{70}. M. E. Bunker, J. P. Mize, and J. W. Starner (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 227-31(1957) Jan. 1.

The radiations of Ga^{70} (21.1 min) have been investigated with β- and γ-scintillation spectrometers. The principal mode of decay is a ground-state β transition of energy 1.65 ± 0.01 Mev. Study of the gamma spectrum has revealed two γ rays with energies and intensities (relative to the total number of disintegrations) of 1.036 ± 0.010 Mev (0.76%) and 0.174 ± 0.005 Mev (0.44%). These two γ rays are in coincidence. From the above facts and the results of beta-gamma coincidence studies, it is concluded that there are two weak β groups with energies and intensities of 0.61 ± 0.02 Mev (0.3%) and 0.44 ± 0.02 Mev (0.5%) leading from Ga^{70} to levels in Ge^{70} at 1.036 and 1.21 Mev, respectively. The angular correlation of the two gamma rays has been measured, and the observed correlation function is in agreement with that expected for the spin sequence 0-2-0. A search for evidence of the 1.21-Mev electric-monopole crossover transition yielded negative results. (auth)

4177

PRELIMINARY INFORMATION ON STUDIES OF RADIOACTIVE RAIN. Fernando Alba A., Virgilio Beltran, T. A. Brody, Hugo Lezama, A Moreno, M. A. Tejera and M. Vazquez B. Rev. mex. fis. 5, 153-66(1956) Oct. (In Spanish)

Data on radioactive rain, which were obtained by the gummed leaf method and by collection in a free surface of water are presented. The experimental methods are described. Some conclusions are obtained on the relative efficiency of the two methods and their relation to atmospheric precipitation. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4178

MASS SPECTROMETRIC INVESTIGATION OF THE RARE EARTH ELEMENTS FOR THE EXISTENCE OF NEW STABLE ISOTOPES. T. L. Collins, F. M. Rourke, and F. A. White (General Electric Co., Schenectady, N. Y.). Phys. Rev. 105, 196-7(1957) Jan. 1.

An earlier study for new isotopes in nature among the more familiar elements has been extended to include yttrium and the rare earth elements. No new isotopes were discovered, but better upper limits have been assigned in most cases. (auth)

SHIELDING

4179 CF-57-1-107

Oak Ridge National Lab., Tenn.

HRT SOURCE SHIELD CALCULATIONS. P. N. Haubenreich and G. W. Rivenbark. Jan. 8, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations indicate that the proposed shielding arrangement will give a dose rate at the surface of the water tank of about 100 mrem per hr, practically all gammas. This is adequate for transportation and handling, but if the radiation actually proves to be this high, a storage location isolated from normal working areas must be provided. The isolation area need not be large, however, since the calculated dose rate at ten feet from the shielded source is only 3.5 mrem per hr. For the short time required to transfer the source from the water tank into the reactor, the Pb carrier alone will provide sufficient shielding. At one meter from the source shielded by the Pb carrier, the dose rate is estimated to be 170 mrem per hr, with neutrons contributing the major part. With reasonable care, the operation should be carried out without excessive exposures. The results of the calculations are summarized. (auth)

4180 KAPL-1441

Knolls Atomic Power Lab., Schenectady, N. Y.

NOTE ON A THEORY OF MINIMUM WEIGHT SHIELDS. H. Hurwitz, Jr. Jan. 23, 1957. 15p. Contract W-31-109-Eng-52. $0.20(OTS).

This note is based on work done in January 1951.

A mathematical solution of the minimum weight problem is obtained under the assumption that the neutron distribution in the shield is determined in advance and does not depend on the distribution of heavy material. (B.J.H.)

4181 ORNL-2194

Oak Ridge National Lab., Tenn.

A MONTE CARLO STUDY OF THE GAMMA-RAY ENERGY FLUX, DOSE RATE, AND BUILDUP FACTORS IN A LEAD-WATER SLAB SHIELD OF FINITE THICKNESS. S. Auslender. Jan. 29, 1957. 27p. Contract W-7405-eng-26. $0.25(OTS).

Calculations were made for 1-, 3-, and 6-Mev photons incident on the slab both along a normal and at an angle of 60°. Results were compared with those obtained by the moments method for monoenergetic, plane monodirectional sources. The results are given in graphical form. (B.J.H.)

4182 ORNL-2224(Vol. II)

Oak Ridge National Lab., Tenn.

TRANSMISSION OF OBLIQUELY INCIDENT GAMMA-RADIATION THROUGH STRATIFIED SLAB BARRIERS. C. D. Zerby. Feb. 8, 1957. 98p. Contract W-7405-eng-26. $0.50(OTS).

Results of a Monte Carlo computation of the penetration of γ radiation through stratified slabs are given. The detailed angular and degraded energy spectrum of penetrating γ radiation and the energy spectrum of the radiation reflected from many of the slabs are presented. (B.J.H.)

4183

REACTOR SHIELDING. E. P. Blizard (Oak Ridge National Lab., Tenn.). Trans. Am. Soc. Mech. Eng. 79, 35-9(1957) Jan.

The problems attendant upon shielding of reactors are described briefly. The sources of radiation and their relative importance are enumerated. The interaction processes for γ rays and neutrons are described; some discussion is given of their relative importance. The need for thermal shields in a reactor is described. Common biological shield materials are enumerated with their relative advantages and disadvantages. Some current shield designs are illustrated. (auth)

SPECTROSCOPY

4184 AD-102749

Arkansas. Univ., Fayetteville. Coll. of Arts and Sciences.

DEVELOPMENT OF AN RF MASS SPECTROMETER FOR TRACE DETECTION. Technical Note No. 17 for the Period April 1, 1956 to June 30, 1956. M. K. Testerman. July 1, 1956. 16p. Contract AF33(616)-15.

A modification of the proposed method utilizing the r-f mass spectrometer for the detection and measurement of

trace materials in gas mixtures is presented. Also described are the newly designed circuits that have been incorporated into this instrument for the improvement of operational stability of the r-f mass spectrometer tube. Preliminary performance tests indicate the r-f mass spectrometer should be capable of performing a continuous analysis of the trace substance and present the results directly in parts per million. (auth)

4185

CALCULATIONS IN NUCLEAR SPECTROSCOPY WITH THE HARMONIC OSCILLATOR SHELL MODEL. R. Thieberger (The Weizmann Inst. of Science, Rehovoth and The Israel Atomic Energy Commission, Tel Aviv). Nuclear Phys. 2, 533-47(1957) Jan.

A summary of the results and methods in the use of harmonic oscillator wave functions in nuclear spectroscopy is presented. (auth)

4186

APPARATUS AND METHODS FOR MEASUREMENTS OF COMBINATION SCATTERING SPECTRA IN GASES. Ya. S. Bobovich and V. M. Pivovarov. Uspekhi Fiz. Nauk 60, 689-708(1956) Dec. (In Russian)

Spectroscopic measurements for spin and spin-oscillation spectra of combined scattering were developed and the gas installations producing the combined scattering are described. The schemes of light source and their efficiencies were compared and experiments were described showing direct recording of the combination scattering in gases, opening great perspectives for precision spectroscopic quantity measurements. (R.V.J.)

4187

SPECTROPHOTOMETRIC METHOD FOR STUDYING THE DISPERSION AND ABSORPTION OF SOLID BODIES. M. P. Lisitsa Shevchenko (Kiev State Univ.). Doklady Akad. Nauk S.S.S.R. 111, 803-5(1956) Dec. 1. (In Russian)

A method is offered for the development of accurate adsorption and dispersion curves within the same spectral area of solid bodies. Three basic variations of the method are analyzed. (R.V.J.)

Refer also to abstracts 3941 and 4003.

THEORETICAL PHYSICS

4188

NON-LINEARITY AND CONFORMAL RECIPROCITY. A. Popovich (Bukharest Rumynian Republic). Doklady Akad. Nauk S.S.S.R. 111, 74-7(1956) Nov. 1. (In Russian)

4189

λ TEMPERATURES OF HELIUM ISOTOPE SOLUTIONS. B. N. Esel'son, N. G. Bereznyak, and M. I. Kaganov (Physico-Technical Inst. USSR). Doklady Akad. Nauk S.S.S.R. 111, 568-70(1956) Nov. 21. (In Russian)

Various methods were developed to record the τ_λ for (x_1) concentrations and a diagram for the liquid-vapor phase of the He^3-He^4 system has been constructed. The break in the curve plotted to express the relations between the vapor elasticity and temperature lead to a new method for determination the value $\tau_\lambda (x_1)$. (R.V.J.)

4190

ANALYSIS OF NUCLEAR QUADRUPOLE MOMENTS ON THE BASIS OF A KINEMATICAL MODEL. R. K. Osborn and E. D. Klema (Oak Ridge National Lab., Tenn.). Nuclear Phys. 2, 454-75(1956) Dec.

The kinematical model used previously in the correlation of nuclear magnetic moments has been applied to the analysis of nuclear quadrupole moments. The empirical rules found in the previous work are in general confirmed; however, the $d_{\frac{3}{2}}$ nuclei form an exceptional group and are discussed in detail. A possible explanation of the anomalous magnetic moment of W^{183} is given. Shape factors are obtained for a number of odd mass nuclei on the basis of the present model. (auth)

4191

THE COUPLING CONSTANTS OF STRONG INTERACTIONS. P. T. Matthews (Univ. of Birmingham, Eng.) and Abdus Salam (St. John's Coll., Cambridge, Eng.). Nuclear Phys. 2, 582-5(1957) Jan.

Some formal restrictions are imposed on the strong interactions between elementary particles, which considerably reduce the number of independent interaction constants which appear in the theory of d'Espagnat and Prentki. (auth)

4192

PHASE SPACE CALCULATIONS. G. E. A. Fialho (Columbia Univ., New York). Phys. Rev. 105, 328-37(1957) Jan. 1.

A new approach is used for the calculation of volumes in phase space, using the saddle point approximation to solve the integrals. Thermodynamic concepts of temperature, free energy, and entropy are used. Results are compared with the nonrelativistic, extreme relativistic, and Fermi approximations. Applications are made to several systems expected (by the Gell-Mann and Pais scheme) to result from collisions usually produced in laboratory. A rough empirical method of calculation is also given. (auth)

4193

ISOTOPIC SPIN AND ANTINUCLEON-NUCLEON SCATTERING. B. J. Malenka and H. Primakoff (Washington Univ., St. Louis, Mo.). Phys. Rev. 105, 338-43(1957) Jan. 1.

The total isotopic spin operator and its square are determined for the quantized nucleon-antinucleon field. In the customary configuration space representation, it is found that in the formula for the total isotopic spin of a system of nucleons and antinucleons, the antinucleons contribute terms with the transposed negatives of the τ operators replacing the corresponding τ's. The form that has been usually anticipated is found only after a suitable canonical transformation. The results are specifically applied to a two-particle system consisting of a nucleon and an antinucleon. Expressions are also obtained for the isotopic spin dependence of the ratio of elastic charge exchange to elastic noncharge exchange scattering of an antiproton by a proton, and, of the ratio of elastic noncharge exchange scattering of an antiproton by a neutron and by a proton. These are discussed and evaluated under certain simplifying assumptions. (auth)

4194

HYDRODYNAMICAL STABILITY AND POINCARE-LYAPUNOV THEORY. I. Richard Bellman (Rand Corp., Santa Monica, Calif.) and G. Milton Wing (Los Alamos Scientific Lab., N. Mex.). Proc. Natl. Acad. Sci. 42, 867-70(1956) Nov.

A theory of hydrodynamical stability is outlined. (B.J.H.)

4195

THE RANGE OF THE INTERACTION BETWEEN DIFFERENT FERMIONS. Michiji Konuma (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 16, 259-64(1956) Oct.

The range of a virtual boson field coming from the transition between two fermions whose masses are different from each other is investigated. The spread of a boson emitted by a heavier fermion is longer than that of the one emitted by a lighter fermion. The range of the exchange force potential between two fermions of different masses is longer than the Compton wave length of the boson. The effects of this range shift on the interaction between hyperons and heavy mesons are considered. (auth)

4196

A RELATIVISTIC WAVE EQUATION FOR A PARTICLE WITH TWO MASS STATES OF SPIN 1 AND 0. Haruo Shimazu (Yokohama National Univ.). Progr. Theoret. Phys. (Japan) 16, 287-98(1956) Oct.

A relativistic wave equation is given which describes a particle having two different mass states of spin 1 and 0. The energy density is positive definite and the usual method of quantization is applicable. (auth)

4197

GENERAL THEORY OF DEUTERON INDUCED REACTION, I—(d,p) AND (d,n) REACTIONS—. Haruo Ui (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 16, 299-319 (1956) Oct.

Taking into account the loosely bound nature of the deuteron, the general theory of compound nucleus formation by deuterons is developed, in which the compound nucleus formation by deuterons is considered as a two step process; first the neutron enters into the target nucleus to form a compound state and then the proton, combined with it, forms another compound state. The stripping process is obtained as the correction terms of the compound nucleus process due to the interaction in the external proton channel. The indirect stripping process is also discussed. (auth)

4198

DEUTERON STRIPPING AND THE COMPOUND NUCLEUS. Masayuki Nagasaki (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 16, 429-46(1956) Nov.

Deuteron stripping (d, p) reactions are investigated as corrections to the ordinary formal theories of nuclear resonance reactions, based on the compound nucleus model, in which the decaying tails of the internal wave functions of various reaction products are neglected. The amplitude for a (d, p) stripping reaction is shown to be due to the overlapping of the decaying tail of the deuteron internal wave function and the wave function of the neutron trapped in the target nucleus. It differs from the Butler stripping amplitude in that the contributions from the configurations in which the proton is within the range of the interaction between the proton and the target nucleus or between the proton and the neutron interacting with the target nucleus, are properly included in the amplitude for the (d, p) reaction due to the formation and the subsequent decay of the compound nucleus. The effects of the compound nucleus formation on the angular distribution of emerging protons are also discussed in connection with the interpretations of some phenomenological calculations hitherto presented. As the formulation is given in a general way, it can be applied also to other cases than the deuteron stripping reaction, such as (p, d) pick-up, (n, p) direct or (t, d) stripping reactions. (auth)

4199

TWO-NUCLEON PROBLEM WITH PION THEORETICAL POTENTIAL, I—DETERMINATION OF COUPLING CONSTANT AND DEUTERON PROBLEM—. Junji Iwadare, Shoichiro Otsuki, and Ryozo Tamagaki (Kyoto Univ.) and Wataro Watari (Hiroshima Univ.). Progr. Theoret. Phys. 16, 455-71(1956) Nov.

Assuming the pion theoretical potential due to the exchange of one pion in the region outside the pion Compton wave length, the deuteron problem is analyzed. Since the deuteron has a large radius on account of its small binding energy, the wave function is strongly affected by the outer part of the potential. This outer part of the pion theoretical potential has the effective coupling constant $g_c^2/4\pi$ between the p-wave pion field and a nucleon as the only variable parameter. Thus we can determine the value of the coupling constant from the deuteron problem as $0.065 < g_c^2/4\pi < 0.090$. This value is in good agreement with that inferred from pion reactions. The form of the deuteron wave function with the pion theoretical potential and its approximate analytical expression are given. Information is obtained that the tensor potential must be negative inside the pion Compton wave length in order to give the bound deuteron state, which is consistent with the pion theoretical potential in the same region. (auth)

4200

TWO-NUCLEON PROBLEM WITH PION THEORETICAL POTENTIAL, II—SINGLET EVEN STATE—. Junji Iwadare, Shoichiro Otsuki, and Ryozo Tamagaki (Kyoto Univ.) and Wataro Watari (Hiroshima Univ.). Progr. Theoret. Phys. (Japan) 16, 472-81(1956) Nov.

Low energy parameters in the singlet even state are analyzed from the point of view of the pion theory. It is shown that the properties which are required for the potential in the singlet even state are as follows: The one-pion-exchange potential in the outer region, a strong attractive force in the region from the pion range to one half of it, which is consistent with the prediction by the two-pion-exchange potential, and a strong repulsion at small distances at least up to $x = 0.20$. The value of the effective coupling constant of the one-pion-exchange potential is limited as $g_c^2/4\pi > 0.07$ by the present analysis. This result, together with that of the article I, gives an allowed region for the coupling constant as $0.07 < g_c^2/4\pi < 0.09$. (auth)

4201

THE EFFECT OF NONCENTRAL FORCES ON BREMSSTRAHLUNG IN NEUTRON-PROTON COLLISIONS. B. L. Timan (Dnepropetrovsk Mining Inst.). Soviet Phys. JETP 3, 711-12(1956) Dec.

The differential cross section for bremsstrahlung in the collision of high energy nucleons is calculated, including the effect of noncentral forces. (auth)

4202

STATISTICAL THEORY OF THE ATOMIC NUCLEUS. III. B. K. Kerimov and A. V. Dzhavadoe (Moscow State Univ.). Soviet Phys. JETP 3, 713-24(1956) Dec.

The statistical model of the nucleus is investigated for uniform and nonuniform density distributions of nucleons. It is shown that a two nucleon central interaction potential, which contains the ordinary nonexchange repulsive force along with the spin exchange force, leads to a saturation of the nuclear binding energy and nuclear density. (auth)

4203

CONTRIBUTION TO THE THEORY OF REACTIONS INVOLVING POLARIZED PARTICLES. A. M. Baldin and M. I. Shirokov (P. N. Lebedev Physical Inst., Academy of Sciences, USSR). Soviet Phys. JETP 3, 757-9(1956) Dec.

In developing the theory of reactions involving polarized particles, the tensor momenta for the two-body problem, when the incident and scattered particles and the particles of the target are in arbitrary spin states, were found. (F.S.)

4204

CORRELATION BETWEEN THE PLANES OF PRODUCTION AND DECAY OF Λ^0-PARTICLES. V. I. Karpman (Minsk Pedagogical Inst.). Soviet Phys. JETP 3, 803-5(1956) Dec.

4205

RADIATIVE DISINTEGRATION OF Λ^0-PARTICLE. P. V. Vavilov. Soviet Phys. JETP 3, 815-17(1956) Dec.

The influence of Λ^0 spin equal to $\frac{1}{2}$ and $\frac{3}{2}$ was investigated mathematically and the influence of the spin upon the shape of the γ-quanta spectrum was studied. (F.S.)

4206

RENORMALIZABILITY OF PSEUDOSCALAR MESON THEORY WITH PSEUDOVECTOR COUPLING. E. N. Avrorin and E. S. Fradkin (Academy of Sciences, USSR). Soviet Phys. JETP 3, 862-5(1957) Jan.

It is shown that the convergence of a pseudoscalar theory

with pseudovector coupling is not improved even when corrections for the propagation function for the mesons (which are connected with the vacuum polarization) are taken into account. (auth)

4207

NUCLEOMESODYNAMICS IN STRONG COUPLING. III. TRANSLATIONAL MOTION, MESON-FIELD MASS AND MAGNETIC MOMENT OF THE NUCLEON. I. M. Dykman and S. I. Pekar (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 3, 882-94(1957) Jan.

An extended nucleon strongly interacting with the meson field is considered. The meson field is assumed pseudoscalar, and the interaction of pseudovector type. This paper is an immediate continuation of the work, in which the nucleon was assumed infinitely heavy (stationary). A method is developed which is based on the expansion of the solution in powers of the reciprocal of the nucleon mass. In zeroth approximation the result corresponds to an infinitely heavy nucleon and coincides with that previously found. The method is applicable only in the case of sufficiently slow (nonrelativistic) motion of the nucleon. The wave function of the system is calculated to the accuracy of terms of first order in the reciprocal of the nucleon mass. The meson-field mass of the nucleon is calculated to the accuracy of terms quadratic in the reciprocal of the nucleon mass. In the limit of strong coupling of the meson field with the nucleon, the nucleon magnetic moment is calculated in terms of an expansion in powers of the reciprocal of the nucleon mass. The first term of the series corresponds to the approximation of the infinitely heavy nucleon, and the following terms give a correction connected with the translational motion. The results obtained indicate that the difference of the magnetic moments of proton and neutron can be explained, not by taking into account the translation motion of the nucleon, but by renouncing the assumption of the limit of strong coupling. (auth)

4208

THE SHAPE OF THE DISPERSION SIGNAL IN NUCLEAR MAGNETIC RESONANCE WITH STRONG HIGH-FREQUENCY MAGNETIC FIELDS. N. M. Ievskaia (Moscow State Univ.). Soviet Phys. JETP 3, 908-13(1957) Jan.

Approximate solutions are given for the system of equations which describe the behavior of the components of the magnetization vector in a strong high-frequency magnetic field for intermediate relaxation times; both symmetrical and asymmetrical sinusoidal modulation are considered. The approximation is investigated and the limits of its applicability indicated. The solution is used to derive expressions for the longitudinal and transverse relaxation times. The theoretical conclusions are found to be in agreement with the results of experimental studies. (auth)

4209

ON THE S-MATRIX FOR PARTICLES WITH ABITRARY SPIN. V. I. Karpman (Minsk State Pedagogical Inst.). Soviet Phys. JETP 3, 934-40(1957) Jan.

A discussion is given of the perturbation theory for particles with arbitrary spin. The properties of the singular functions for such particles are discussed. It is shown that the elements of the S-matrix may be found by the Feynman rules. (auth)

4210

ON THE THEORY OF HYPERONS. R. S. Ingraden (Polish Academy of Sciences). Soviet Phys. JETP 3, 969-70(1957) Jan.

A theory of hyperons is discussed in which an internal structure similar to that of the hydrogen atom is attributed to the nucleon. (B.J.H.)

4211

METHOD OF GROUP THEORY IN QUANTUM PHYSICS OF A SOLID BODY (THEORY OF POINT THEORY). A. V. Sokolov and V. P. Shirokovskiĭ. Uspekhi Fiz. Nauk 60, 617-88(1956) Dec. (In Russian)

The general principles of group theory applied to quantum mechanics and physics of solid body are reviewed. Problems of the law of conservation and total assembly of physical values were analyzed and electronic states in crystalline fields are described. Also, the problems of atomic energy level resolution in crystals, considering the spin and without consideration for the spin are evaluated and the general rules are given. (R.V.J.)

URANIUM AND URANIUM COMPOUNDS

4212 DP-139

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

MECHANICAL PROPERTIES OF STRIATED URANIUM SLUGS. M. L. Holzworth. Nov. 1955. 27p. Contract AT(07-2)-1. $0.25(OTS).

Nonmetallic inclusions, which are described as "striations," have no adverse effect on the tensile, impact, torsion, or fatigue strength of U slugs. Mechanical properties of the slugs are primarily dependent on crystallographic orientation, which may be varied by heat treatment of the metal. (auth)

4213 ORNL-2126

Oak Ridge National Lab., Tenn.

THE BUILDUP OF HEAVY ISOTOPES DURING THERMAL NEUTRON IRRADIATION OF URANIUM REACTOR FUELS. J. O. Blomeke. Jan. 11, 1957. 62p. Contract W-7405-eng-26. $0.40(OTS).

Curves suitable for predicting the buildup of heavy isotopes in uranium reactor fuel of any likely initial isotopic composition are presented. The curves were computed for seven values of thermal neutron flux between 10^{12} and 10^{15} n/cm^2/sec, assuming constant flux, and extended to flux-times of 3×10^{21} n/cm^2. (auth)

4214 WAPD-144

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THERMODYNAMICS OF THE SYSTEM URANIUM–OXYGEN. Carl Wagner. July 23, 1955. 38p. For Westinghouse Electric Corp. Bettis Plant. Contract AT-11-1-GEN-14. $0.30(OTS).

4215 WIAP-M-36

Westinghouse Electric Corp. Industrial Atomic Power Section, McKeesport, Penna.

THE KINETICS OF NUCLEAR FUEL CONSUMPTION AND PRODUCTION, U-238, U-235 MIXTURES. J. M. Stein. Feb. 25, 1954. 8p. $1.80(ph OTS); $1.80(mf OTS).

The variation in composition of U as a function of irradiation time is determined by an analytical solution of the transient equations. A mixture of U^{238} and U^{235} is considered. The derivation leads to accurate analytic expressions for the cross sections and heat generation. (B.J.H.)

4216

HOW TO INTEGRATE THE U^{235} FISSION-NEUTRON SPECTRUM. F. T. Binford (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 2, 94-5(1957) Feb.